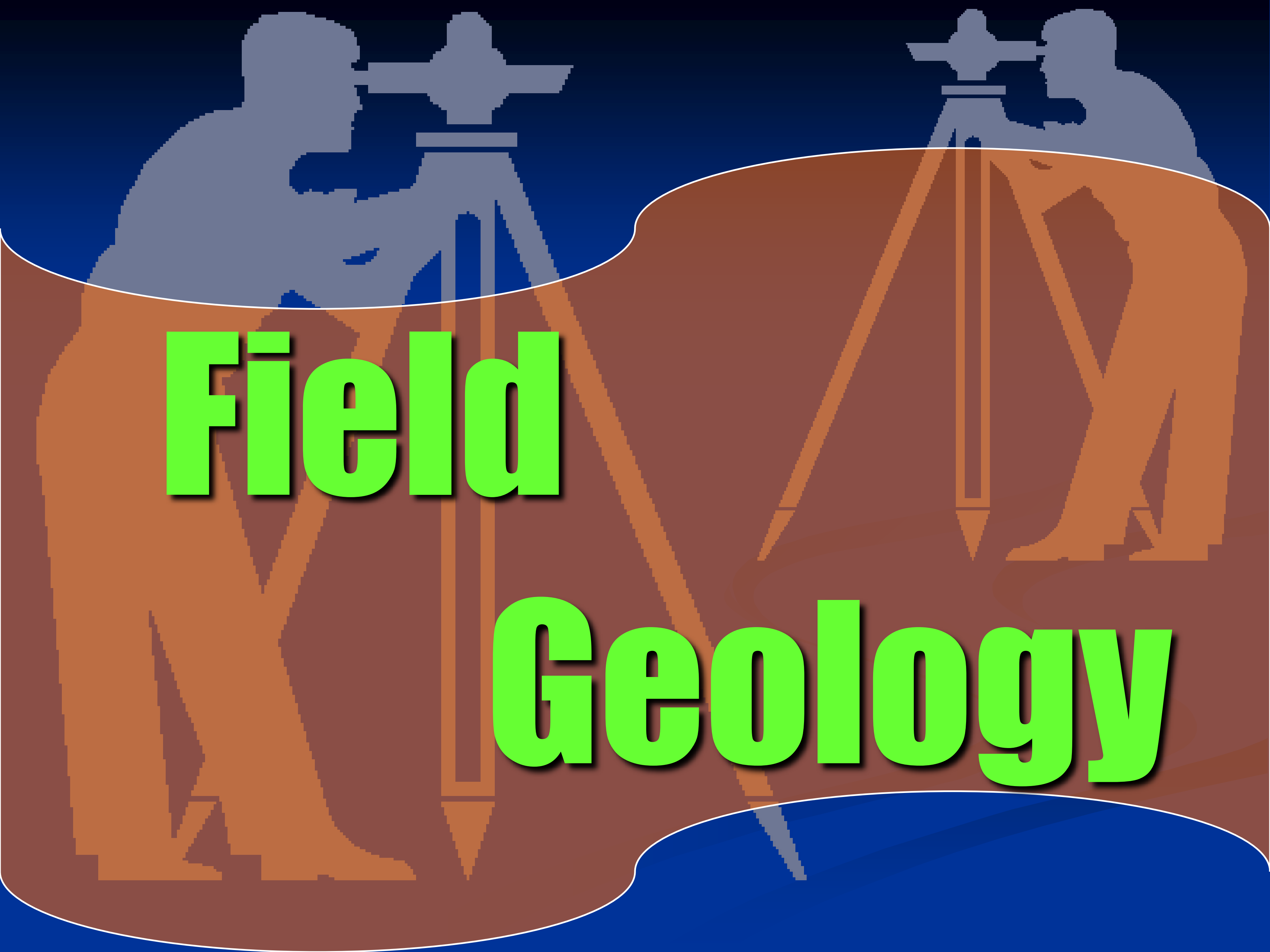
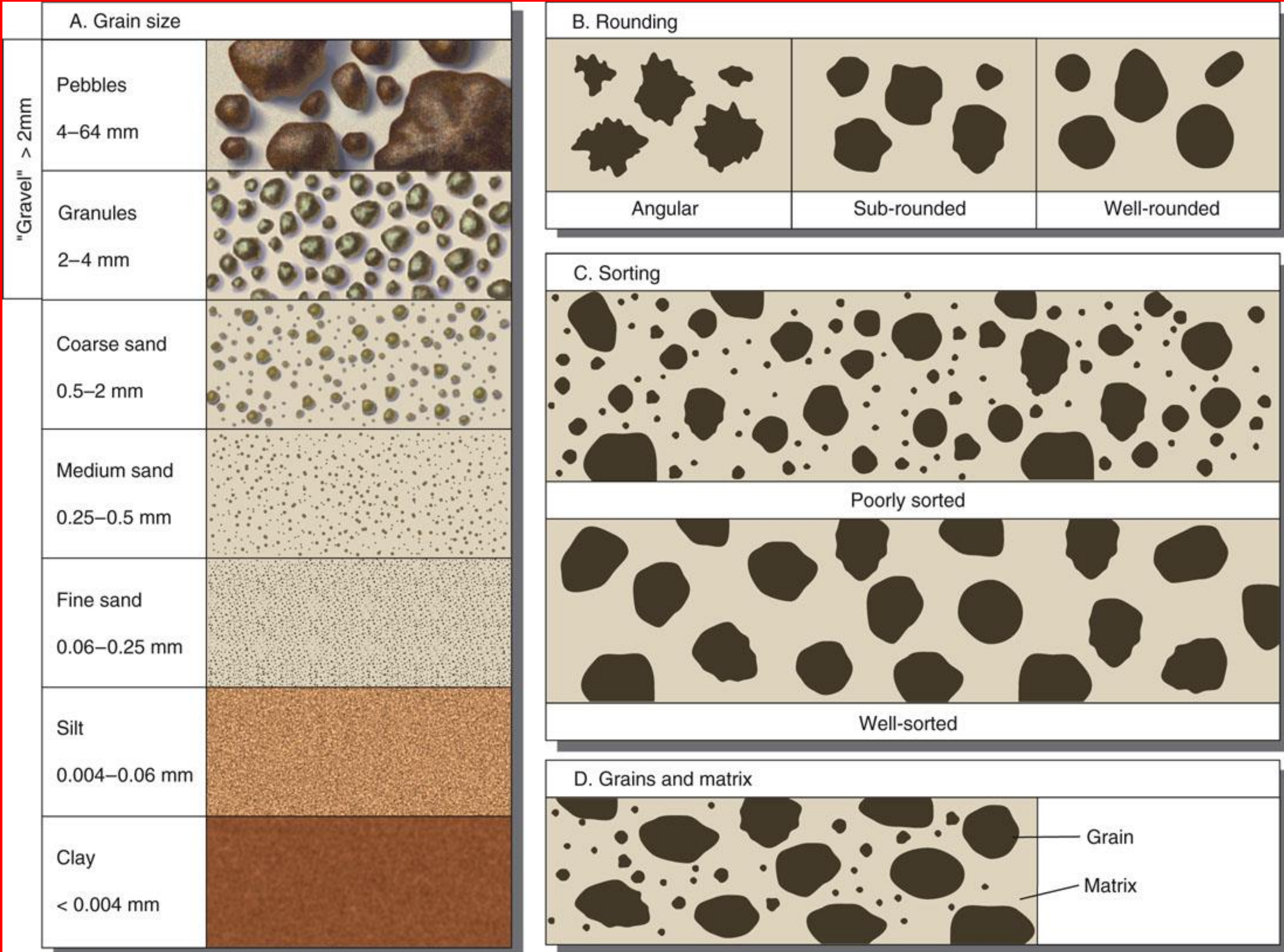

Field
Geology

Introduction

- Before going out into the field it is necessary to: (1) assemble all of the field equipment that you might need; (2) assess any safety issues; and (3) if necessary obtain permission to visit the area. Both the safety and permission aspects may require documentation to be completed. Exactly what equipment you will need depends on the type of fieldwork you will be undertaking. The items required for most fieldwork tasks are listed in Table

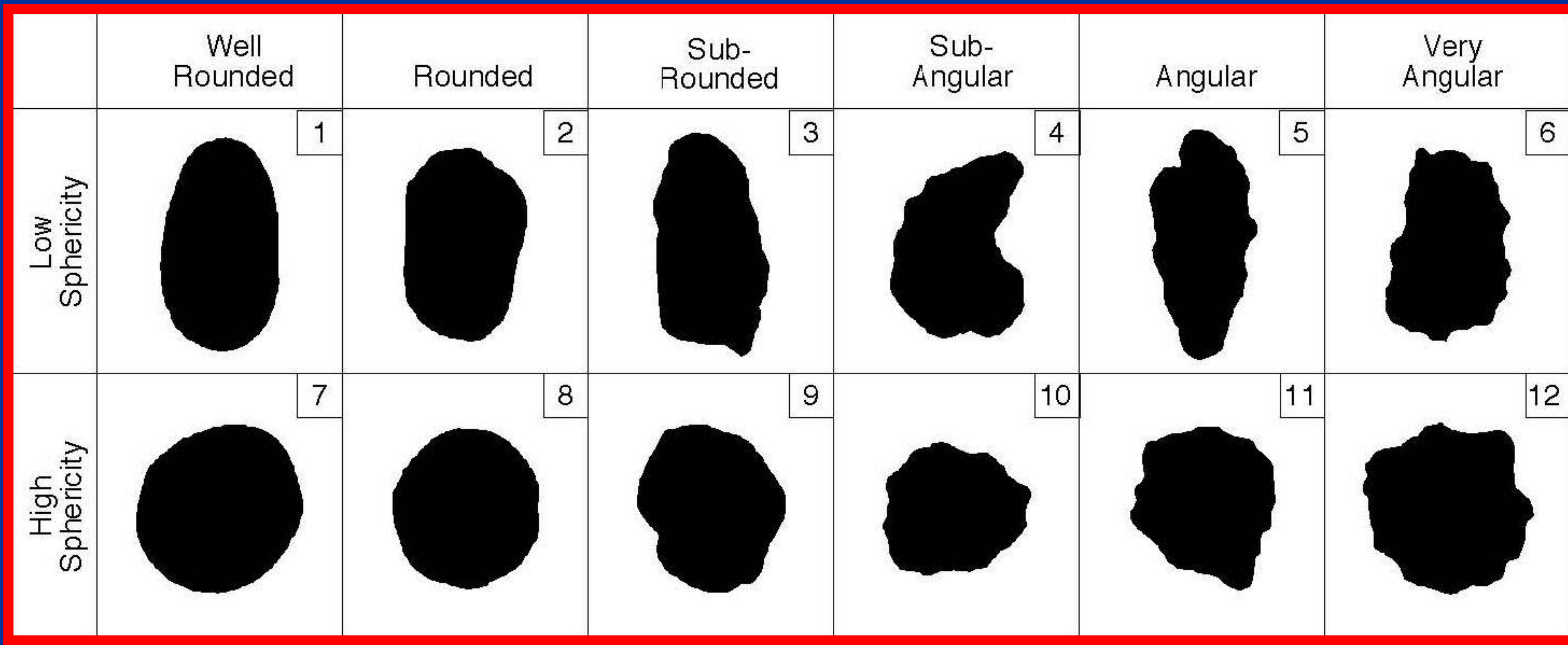
Table1 :Equipment Required for most Geological Fieldwork

1	Field notebook
2	Pencils, eraser, pencil sharpener A few coloured pencils
3	Tape measure, surveyor’s tape or folding ruler
4	Hand lens, Compass - clinometer
5	Comparison and identification charts appropriate to the task
6	Relevant topographical maps

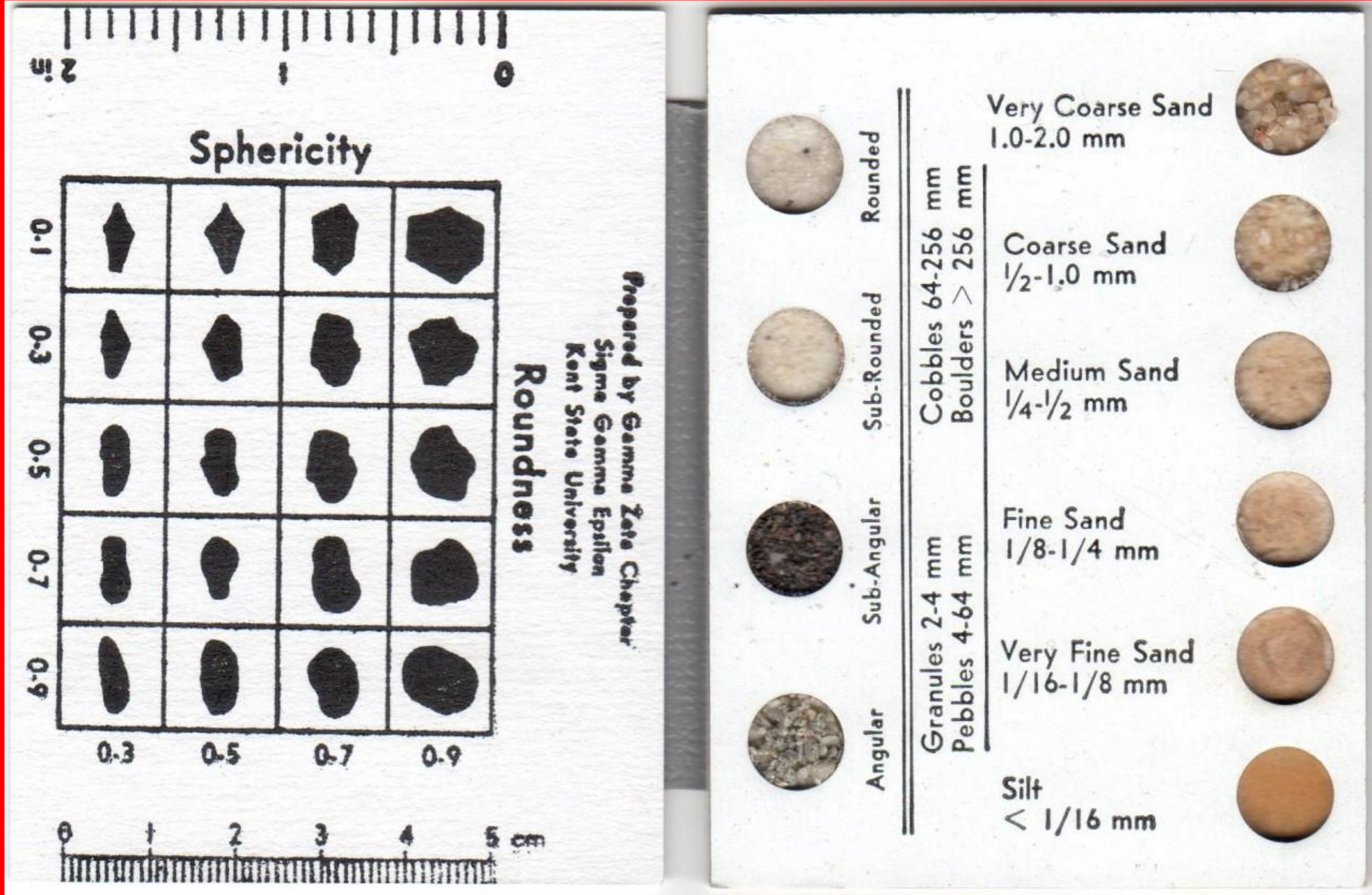


A. Grain size
"Gravel" > 2mm
Pebbles
4–64 mm
Granules
2–4 mm
Coarse sand
0.5–2 mm
Medium sand
0.25–0.5 mm
Fine sand
0.06–0.25 mm
Silt
0.004–0.06 mm
Clay
< 0.004 mm
B. Rounding
Angular
Sub-rounded
Well-rounded
C. Sorting
Poorly sorted
Well-sorted
D. Grains and matrix
Grain
Matrix

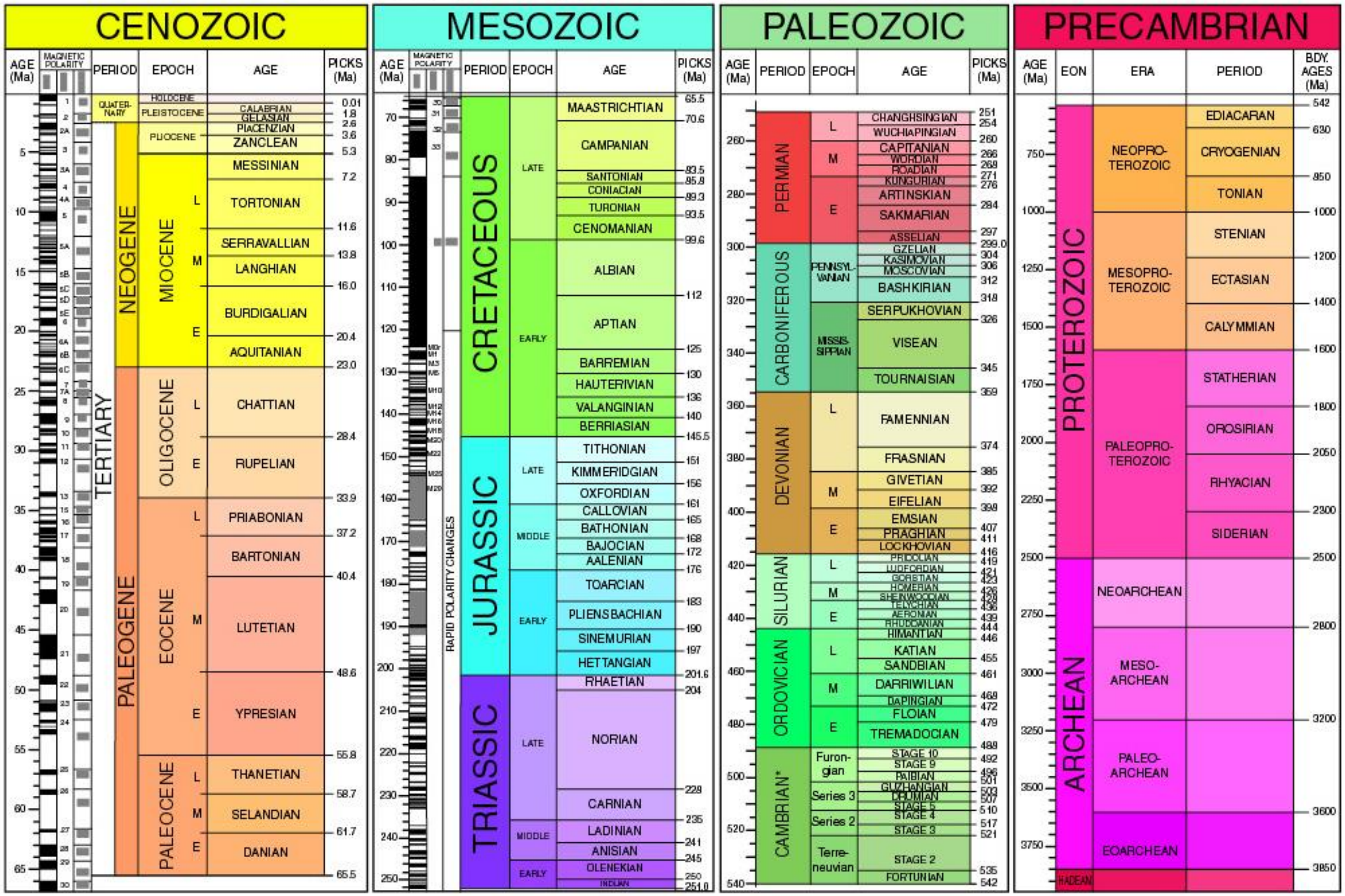
Roundness Chart



Sand Grains Size Chart



2009 GEOLOGIC TIME SCALE



*International ages have not been fully established. These are current names as reported by the International Commission on Stratigraphy.

Walker, J.D., and Geissman, J.W., compilers, 2009, Geologic Time Scale: Geological Society of America, doi: 10.1130/2009.CTS004R2C. ©2009 The Geological Society of America.

Sources for nomenclature and ages are primarily from Gradstein, F., Ogg, J., Smith, A., et al., 2004, A Geologic Time Scale 2004: Cambridge University Press, 589 p. Modifications to the Triassic after: Furin, S., Preto, N., Rigo, M., Roghi, G., Gianolla, P., Crowley, J.L., and Bowring, S.A., 2006, High-precision U-Pb zircon age from the Triassic of Italy: Implications for the Triassic time scale and the Carnian origin of calcareous nannoplankton and dinosaurs: Geology, v. 34, p. 1009–1012, doi: 10.1130/G22967A.1; and Kent, D.V., and Olsen, P.E., 2008, Early Jurassic magnetostratigraphy and paleolatitudes from the Hartford continental rift basin (eastern North America): Testing for polarity bias and abrupt polar wander in association with the central Atlantic magmatic province: Journal of Geophysical Research, v. 113, B06105, doi: 10.1029/2007JB005407.

THE GEOLOGICAL SOCIETY OF AMERICA®

Table1 :Equipment Required for most Geological Fieldwork.

7	Backpack/rucksack
8	Food and water sufficient for the fieldwork period
9	Emergency food supplies
10	Suitable clothing and footwear
11	Spare clothing and/or sunblock as appropriate
12	Mobile phone, radio or satellite Phone
13	Safety equipment as appropriate

- **A variety of different hand lenses.**
- **(1) Standard 10 ×; single lens;**
- **(2) 10 × lens with built-in light – the lens casing matches the focal length;**
- **(3) 8 × lens with built - in light;**
- **(4) 10 × and 15 × dual lens.**

Introduction

- Geological field work, like any other endeavour, requires to be properly organized even if the visit is for a short duration.
- The extent of preparation and planning will depend on the nature of the project, but there are certain basic things which must be attended to for making it a success, be it systematic mapping of a large area or a brief examination with a limited aim.
- Geological fieldwork is a serious exercise, and any casual approach may affect its accuracy and therefore its usefulness.

Planning a Field Project

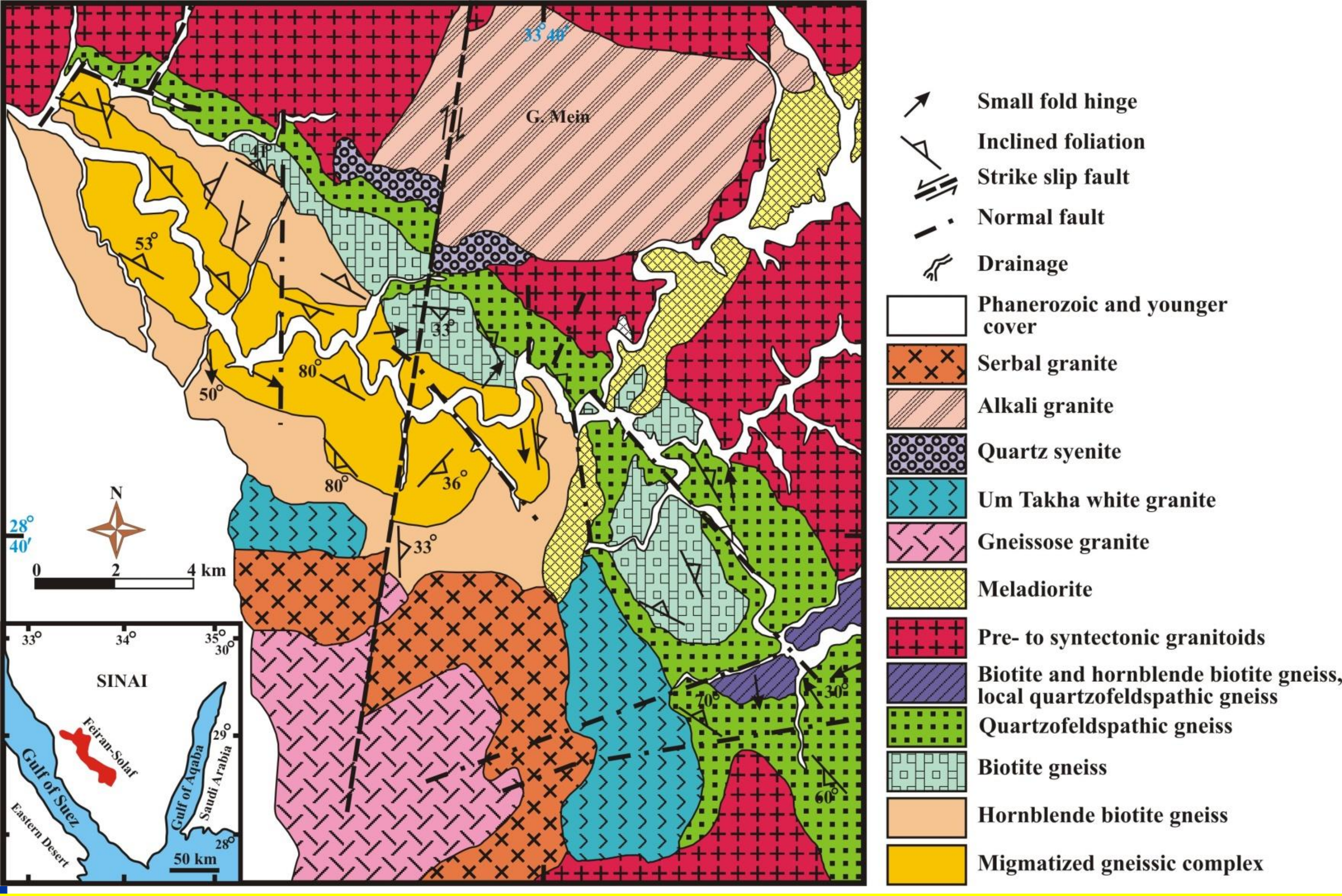
- Geologic field projects generally proceed in three stages: the stage of planning; the stage of mapping, observing, and collecting; and the stage of preparing a report.
- The effectiveness of a project is determined largely during the planning stage.
- It is wise to plan a project in such a way that its scope can be increased or changed to a reasonable degree during the field season.
- For this reason, moderate amounts of extra equipment and supplies should be taken to the field. Although specific steps vary, the following recommendations should be considered in planning.

Planning a Field Project

- 1. Determine if other geologists are working in or near the area of interest.
- 2. Accumulate and study reports and maps of the region in order to gain an understanding of the broader features of the geology and geography. Determine what is known, specifically, about the problems and relations that fall within the scope of the study being planned.
- 3. Visit the area in order to reconnoiter its topography and geology and to obtain permission for camping, mapping, and collecting. If a visit is not possible, do these things as completely as correspondence and discussions will permit.

Planning a Field Project

- 4. Determine the scales and quality of maps and aerial photographs of the area. If these will not provide an adequate base for geologic mapping, consider what means will be used to construct a map. Will a topographic (contour) map be needed? What is the smallest map scale that will be useful? What are the most efficient surveying methods which will give adequate precision to the work?
- 5. Evaluate the probable schedule and costs of the project. To do this effectively, consider not only the mapping procedures but also how well the rocks are exposed, how accessible the area is from a base camp or office, and to what degree the weather is likely to interfere with field work.



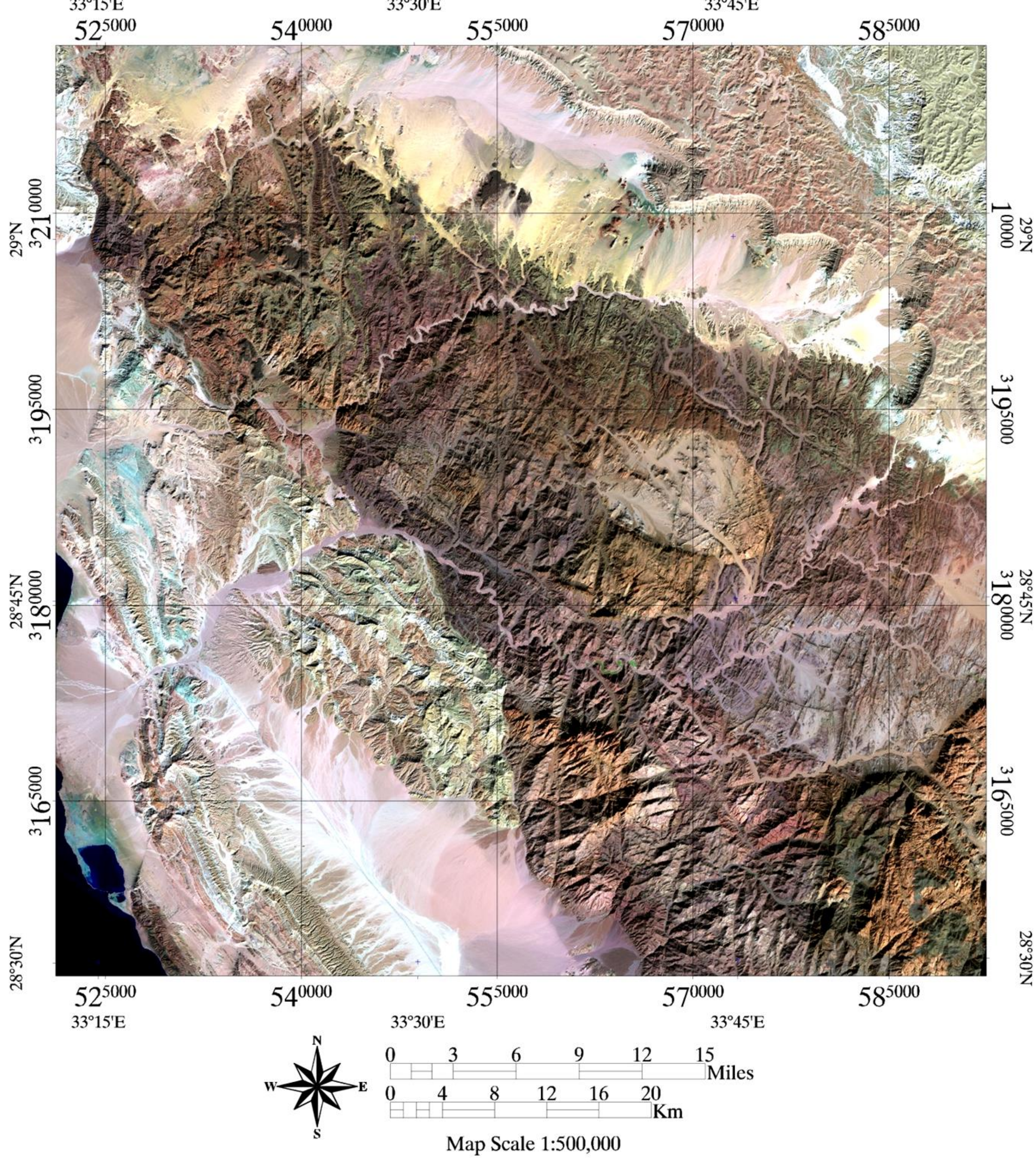
A geological map is a picture of the rocks that make up the "face of the earth".

Planning a Field Project

- 6. Order maps, aerial photographs, and various other field and office equipment, allowing plenty of time for delivery.
- 7. Reread critically all reports that pertain to the area, as well as books or papers that present basic ideas and methods pertinent to the project. Accumulate as complete a field library as possible, and photograph, copy, or abstract items that cannot be taken to the field.

Landsat of Feiran-Solaf

Metamorphic Belt



Gov’t maps, reports, advice

Previous Literature and Maps

- Before embarking on a field assignment, the geologist should read up on any available literature and consult previous maps of the target areas as well as those of the adjoining areas and regions having similar geological framework.

Previous Literature and Maps

After all,

a geologist is an explorer and is expected to be able to face any type of challenge in the territory to be traversed.

Physiography

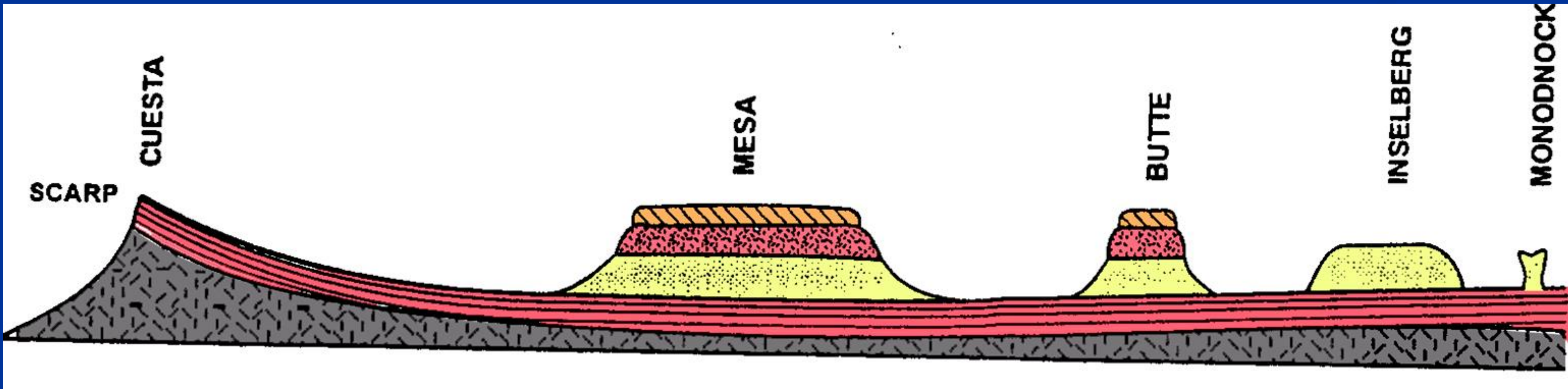
- There is often a close relationship between the geology and the topograpy of the area, and both should be studied together. Rock exposures shape landforms. Certain rock types and structures produce distinct relief.
- **Topographic Expressions and Relief**
- The physical features of any part of the Earth's surface assume myriad forms, all shaped by geological processes, particularly erosion and tectonics. Some prominent features of relief that the fieldworker is likely to encounter are mentioned here (Fig. 1.1). It is desirable to identify these forms and to name them correctly.

Wadi El Raha, Sinai

Topographic Expressions and Relief

- **Cuesta** is a landform created by gently inclined harder strata which create a dip slope on one side and terminate with a steep slope or scarp on the other, forming a capping over the softer rocks.
- **Scarp or Escarpment** is an inland cliff or steep, relatively straight linear face of a cuesta or plateau, possibly produced by faulting or erosion.
- **Cliff** is a high, very steep, perpendicular or overhanging rock face, either along a coastline or inland, mainly formed by erosion.

Some landforms



Topographic Expressions and Relief

- **Bluff** is a kind of cliff which has almost a perpendicular front overlooking a plain, sometimes hanging over the rock underneath.
- **Precipice**, is the high, steep or vertical rock face of a cliff or mountain.
- **Mesa** is a high, flat, rocky, table-like isolated upland with precipitous slopes all around.

Topographic Expressions and Relief

- **Butte** is an isolated, flat-topped landmass standing distinctly above the surrounding country similar to a mesa but much smaller, and is often produced from a mesa when it gets reduced in size through erosion and dissection.
- **Inselberg** is a prominent isolated hill-like rock feature rising abruptly from and surrounded by an extensive lowland.
- **Monadnock** is a remnant hill or mass of resistant rock which has been left standing above the surrounding country that has been peneplained by erosion. It can be regarded as a type of inselberg.

Monodnock , White Desert , Bahariya oasis of Egypt


Inselberg, White Desert , Bahariya oasis of Egypt
Fathy Mohamed, Alex. University

Monodnock , White Desert , Bahariya oasis of Egypt

Monodnock , White Desert , Bahariya oasis of Egypt

Fathy Mohamed,
Alex. University

Monodnock , White Desert , Bahariya oasis of Egypt

Topographic Expressions and Relief

- Subaerial denudation over a long period of time produces low-lying surfaces which are the ultimate product of old age. A **peneplain** is formed owing to erosion by rivers and rain until almost all the elevated features are worn down.
  It is a nearly featureless, gently undulating land surface of low relief occupying a large area.
  Isolated residual masses of resistant rocks like monadnocks or inselbergs may be left standing.
- A broad landscape of low relief broken by isolated residual uplands formed by subaerial denudation in arid regions is known as a **pediplain**. It may consist of several **pediments** which are surfaces of low relief, strewn with boulders, that slope away from residual uplands at low angles; they have a long concave profile.

Pediplain, White Desert , Bahariya oasis of Egypt

Equipment and Supplies

- The basic equipment needed for examining, describing, and collecting rocks is modest in amount and need not be expensive.
- It consists of a hammer with either a pick or chisel point at one end, a hand lens, a pocket knife, a notebook or looseleaf clip folder, a 2H or 3H pencil or a good ballpoint pen, a 6-inch scale, heavy paper or cloth bags for collecting samples

Equipment and Supplies

Basic equipment

- 1. Geological hammers
- 2. Compass with clinometer (Brunton/Clino compass)
- 3. Pocket lens
- 4. Field notebook
- 5. Maps/aerial photograp
- 6. Hydrochloric acid
- 7. Streak plate
- 8. Pocket magnet
- 9. Pocket knife
- 10. Measuring tapes and scales
- 11. Camera, film, accessories
- 12. GPS receiver
- 13. Haversack/Rucksack

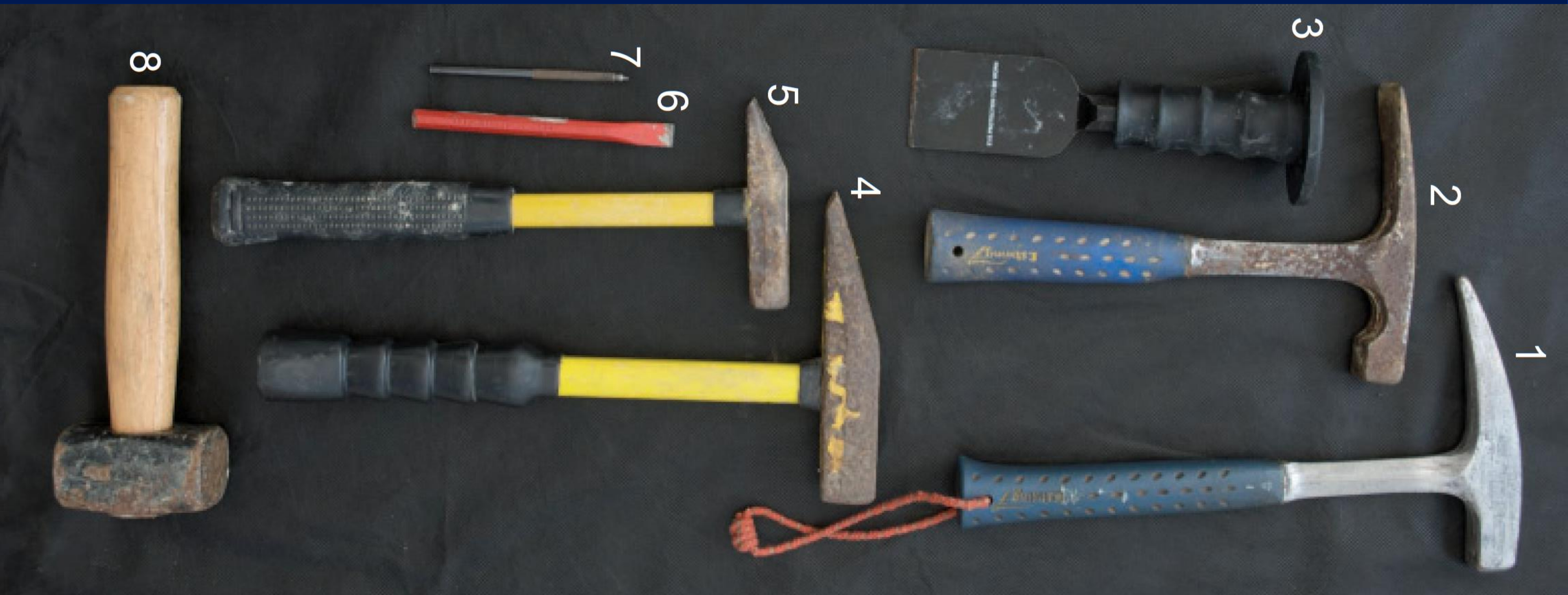
Equipment and Supplies

- **Additional requirements**
- 1. Pencils, erasers, sharpeners
- 2. Black and coloured drawing inks and pens
- 3. Permanent marker pens
- 4. Tracing paper/film
- 5. Graph paper
- 6. Writing paper, white
- 7. Adhesive tape for labelling
- 8. Old newspaper for wrapping specimens
- 9. Specimen bags and boxes

Equipment and Supplies

- **Supplementary supplies**
- 1. Cold chisels
- 2. Protractors
- 3. Set squares
- 4. Hand lens (Reading glass)
- 5. Pocket calculator
- 6. Medical supplies

Hammer, chisels and other hardware



- **Figure 2.18** Some of the different geological hammers and cold chisels available on the market. (1) Estwing pick end hammer, (2) Estwing chisel end hammer, (3) cold chisel with hand guard, (4 and 5) 2.5 lb and 1 lb geological hammers with fibreglass shafts, (6) pencil chisel, (7) tile scribe and (8) lump hammer.

Field Documentation

The Notebook

- Careful documentation of the minutest details of all field observations is absolutely essential. These should be entered in a hard-bound notebook of a size that can be conveniently carried in the pocket.
- You should record as much detail as possible and fully illustrate your notebook with sketches (3D if possible), interpretative sections and maps. Nothing is more frustrating upon returning to the laboratory than finding that your field notes are incomplete.

The Notebook

- The key to producing good field notes is keen, careful observation and systematic recording. The following recording procedure should be adopted at every locality:
- 1: Date, time and location of your observations. Use grid references and aerial photograph reference number where appropriate.
- 2: Resume of your mapping method—e.g. traverse up Steamboat Creek from road bridge at Km 14.
- 3: Outcrop locality number—to be also marked on your field map. Include a brief summary of the outcrop characteristics—size and general nature of the exposure.

The Notebook

- 4: Record the lithological characteristics.
- 5: Record the structural characteristics—descriptions and measurements.
- 6: Sketch the outcrop and structural relationships.
- 7: Record the collection of samples and the photographs taken.
- 8 Interpret the outcrop in terms of the regional setting and draw sketches of the structural relationships.

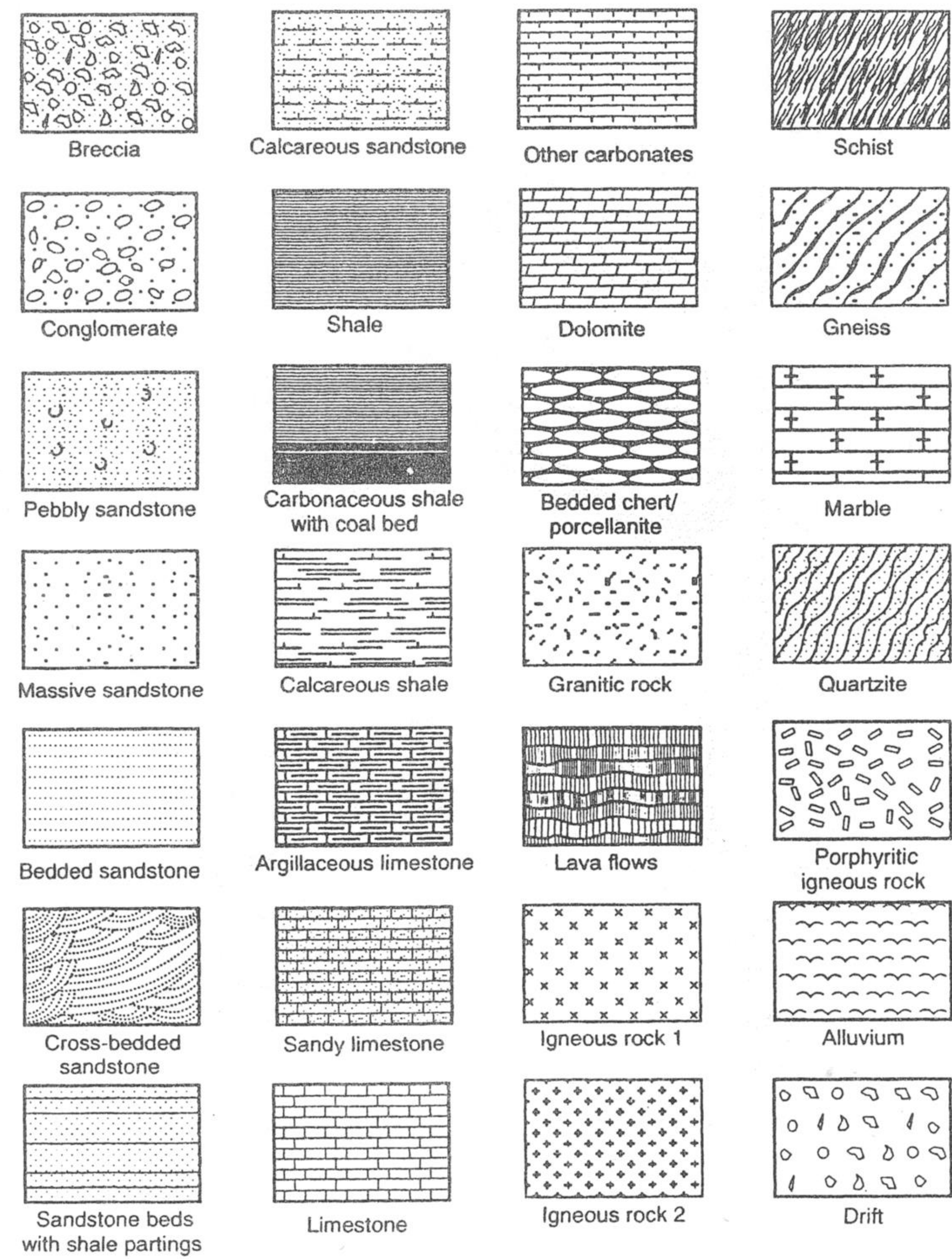
The NotebooK

- It is useful to review the notes at the end of the day to understand the value of each entry. ***It is better to record more details than to record less***, for such a habit may avoid a revisit to the same exposure for finding the details found inadequate or missing at a later date.
- After a while, when the geologist becomes familiar with the area, the experience gained is bound to lead him to observe and record all critical details.

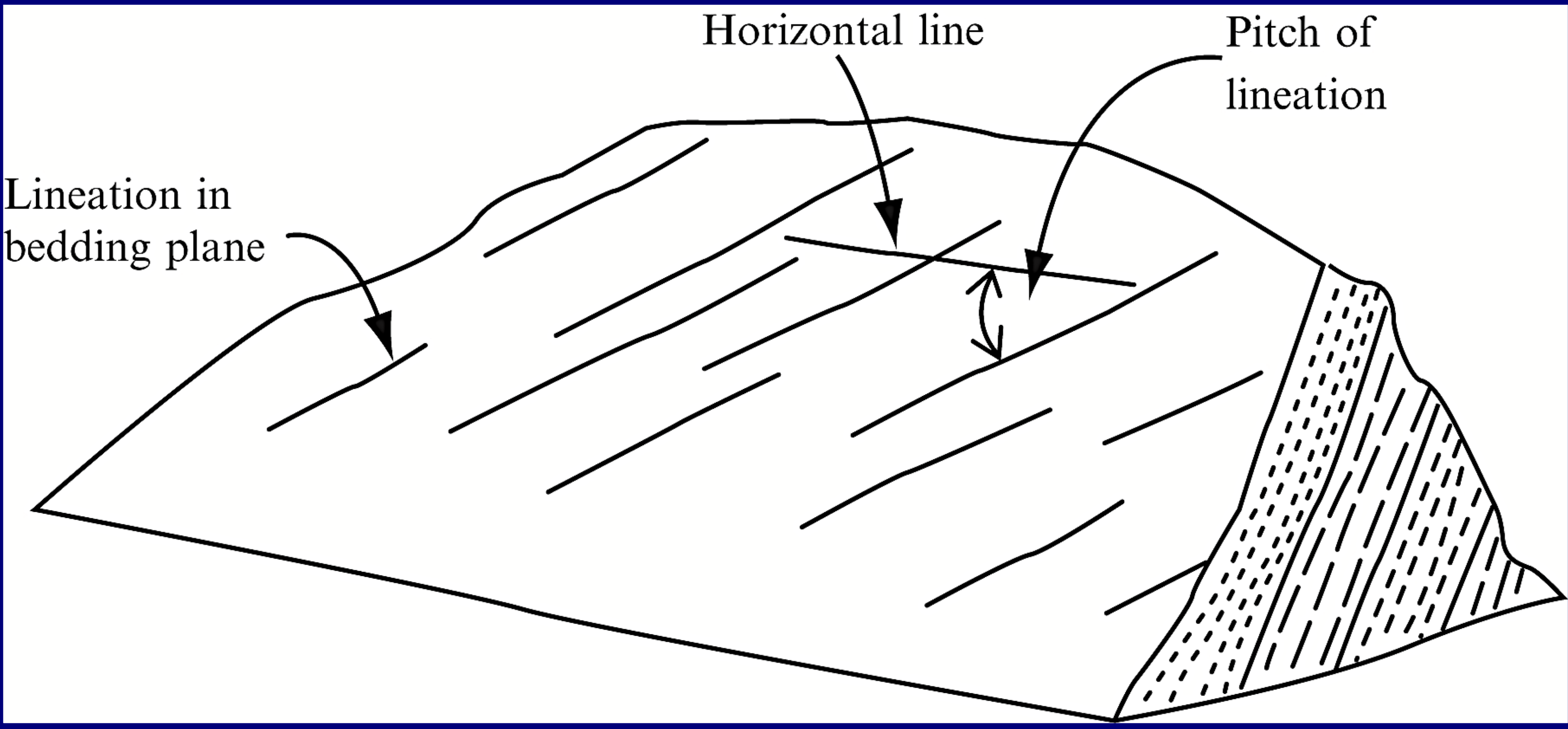
The Notebook

- Describe as fully as possible the rock type or lithology and all features observed by the naked eye and/or using the hand lens. No feature however minor or apparently unimportant should be ignored.
- It sometimes turns out later that a minor feature holds the key or clue to solution of an important problem, or may even lead to a new discovery.
- ***It is sufficient to record some of the attributes by standard symbols or abbreviations that are understood by everyone.***

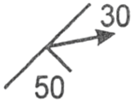
Black & White Rock Symbols



Lineation and Pitch of lineation



Undulated bed with general dip

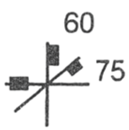


Strike and dip of beds and plunge o
slickensides

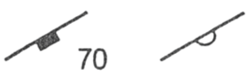
Strike and dip of joint

Strike of vertical joint

Horizontal joint



Strike and dips of multiple joints



Strike and dip of dykes or veins

Strike and dip of vertical dykes or veins

Clear contact showing dips

Clear vertical contact

Approximate contact

Inferred contact

Concealed contact

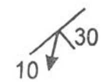
Gradational contact

Trend and plunge of lineation

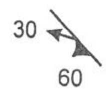
Vertical lineation

Trend of horizontal lineation

Double lineation



Strike and dip of beds and plunge of lineation

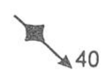


Strike and dip of foliation and plunge of lineation

Strike and dip of beds showing horizontal lineation

Strike and dip of foliation showing horizontal lineation

Vertical beds, showing plunge of lineation



Vertical foliation, showing plunge of lineation

Vertical beds, showing horizontal lineation

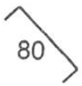
Vertical foliation, showing horizontal lineation

Strike and dip of beds, showing rake of lineation

Strike and dip of foliation showing rake of lineation

Generalized strike of folded beds or foliation, showing plunge of fold axes

Strike and dip of foliation



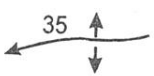
Strike and dip of cleavage

Strike of vertical foliation


Strike of vertical cleavage


Horizontal foliation


Horizontal cleavage

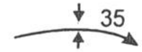


Anticline, showing crestline and plunge

Asymmetric anticline, steep limb to south

Overturned anticline, showing trace of axial surface, dip of limbs, and plunge

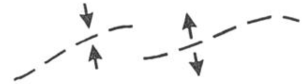

Doubly plunging anticline, showing culmination



Syncline, showing crestline and plunge

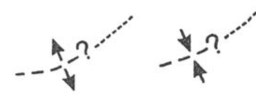

Overturned syncline, showing trace of axial plane and direction of dip of limbs

Minor syncline, showing plunge


Approximate axes of fold

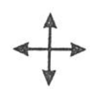

Inferred axes of fold

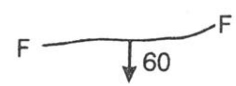

Concealed axes of fold


Doubtful axes of fold, dotted where concealed

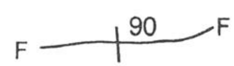

Recumbent fold axes


Plunge of fold axis


Dome



Fault, showing dip

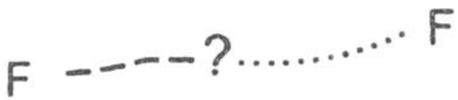


Vertical fault

Approximate fault

Inferred fault

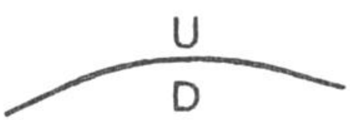
Concealed fault



Doubtful or probable fault, dotted where concealed

Normal fault (ticks on downthrow side)

Fault, showing relative movement



High angle fault, movement—U(up) and D(down)

Thrust or low-angle reverse fault, T, upper plate

Thrust or reverse fault (sawteeth on side of upper plate)

Fault, showing bearing and plunge of grooves, striations, or slickensides

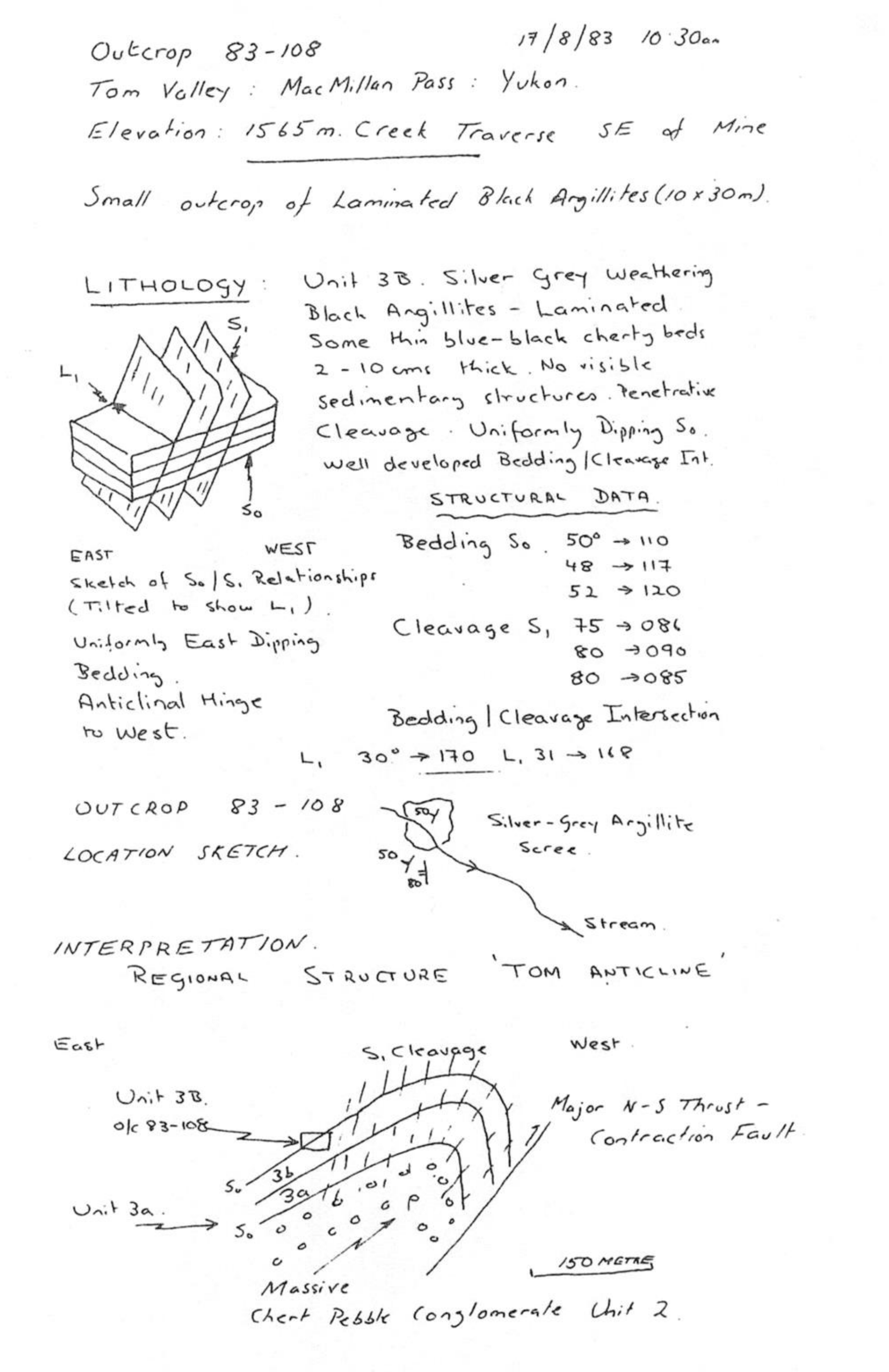
Reverse fault, showing bearing and plunge of relative movement of downthrown block (D)

Fault zone or shear zone, showing dip

The Notebook

- At the close of the season or before leaving a particular area, do not hesitate to revisit an outcrop or a section about which you have a doubt, for you may not be able to visit that locality again at all or for a long time to come.
- Examples of field notebooks
- Examples of field notebooks are shown in the Figure. The Fig. shows the information collected at one small outcrop in the course of a regional mapping programe.

Example of field notebooks



Outcrop 83-108 17/8/83 10:30am
Tom Valley : MacMillan Pass : Yukon.
Elevation: 1565m. Creek Traverse SE of Mine

Small outcrop of Laminated Black Argillites (10 x 30m).

LITHOLOGY: Unit 3B. Silver Grey weathering Black Argillites - Laminated. Some thin blue-black cherty beds 2 - 10 cms thick. No visible sedimentary structures. Penetrative Cleavage. Uniformly Dipping S_0. well developed Bedding/Cleavage Int.

L_1 S_1 S_0

EAST WEST
Sketch of S_0/S_1 Relationships (Tilted to show L_1).

Uniformly East Dipping Bedding. Anticlinal Hinge to West.

STRUCTURAL DATA.

Bedding S_0. 50° → 110
48 → 117
52 → 120

Cleavage S_1 75 → 086
80 → 090
80 → 085

Bedding / Cleavage Intersection
L_1 30° → 170 L_1 31 → 168

OUTCROP 83 - 108
LOCATION SKETCH.

50 80 Silver-Grey Argillite Scree. Stream.

INTERPRETATION.
REGIONAL STRUCTURE 'TOM ANTICLINE'

East S_1 Cleavage West
Unit 3B. o/c 83-108
Major N-S Thrust - Contraction Fault
S_0 3b 3a
Unit 3a. S_0
150 METRE
Massive Chert Pebble Conglomerate Unit 2.

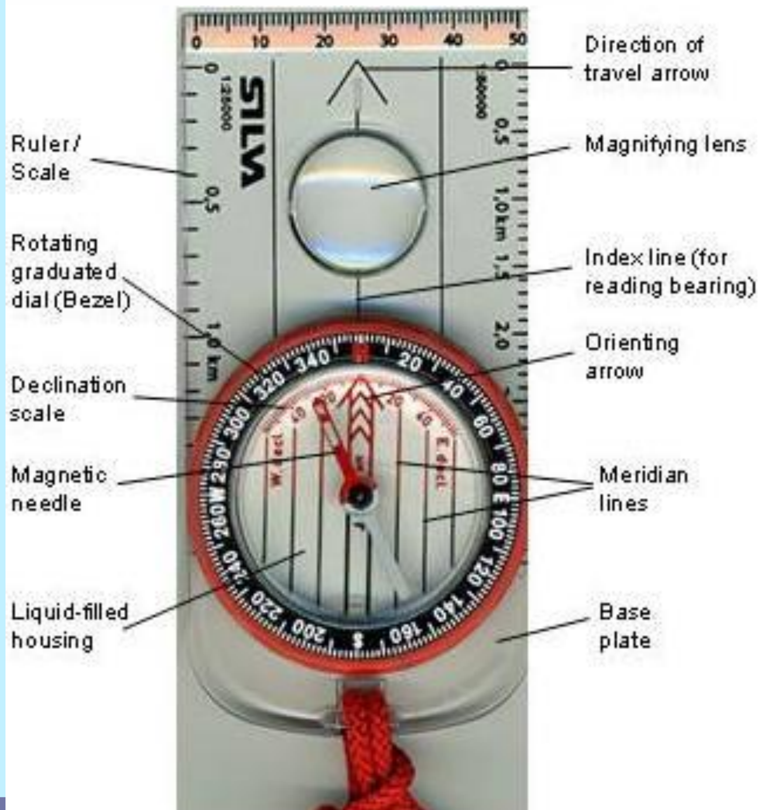
Compass

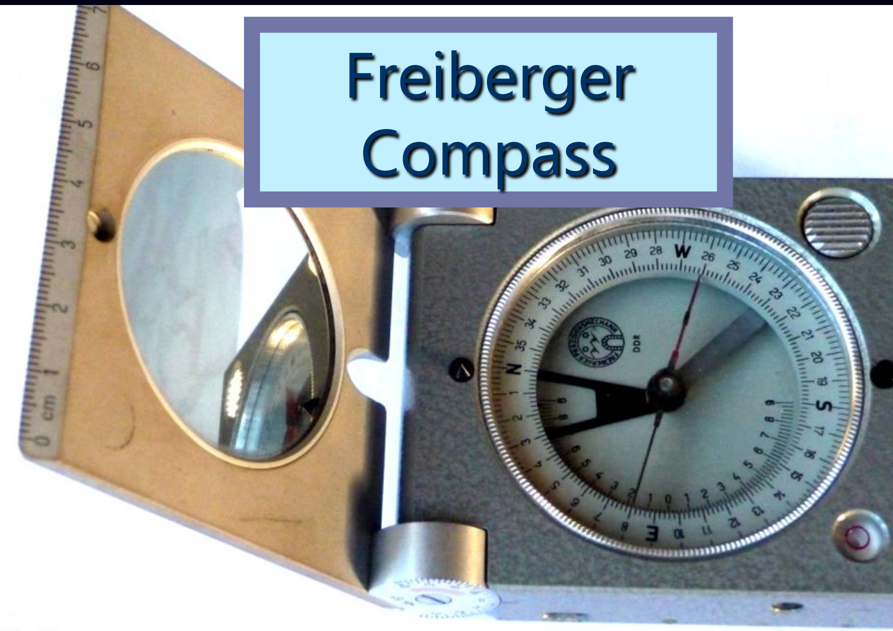
Compass Tutorial

- The compass - clinometer is used to measure: (1) the orientation of geological planes and lineations with respect to north; and (2) the angle of dip of geological features with respect to the horizontal. This allows an accurate record of the geometry of the features to be constructed. The compass - clinometer can also be used in conjunction with a topographic map to accurately determine location.
- There are two main types of compass - clinometer design on the market: the first type is made by Brunton, USA, Freiberger, Germany ; the second type is made by Silva and Suunto, both based in Sweden. The Brunton - type compass-clinometer is a more sensitive device because of the in - built spirit levels and the graduation of the scales in 1° rather than 2° increments.

Types of Compasses

Silva Compass





Freiberger Compass

Brunton Compass

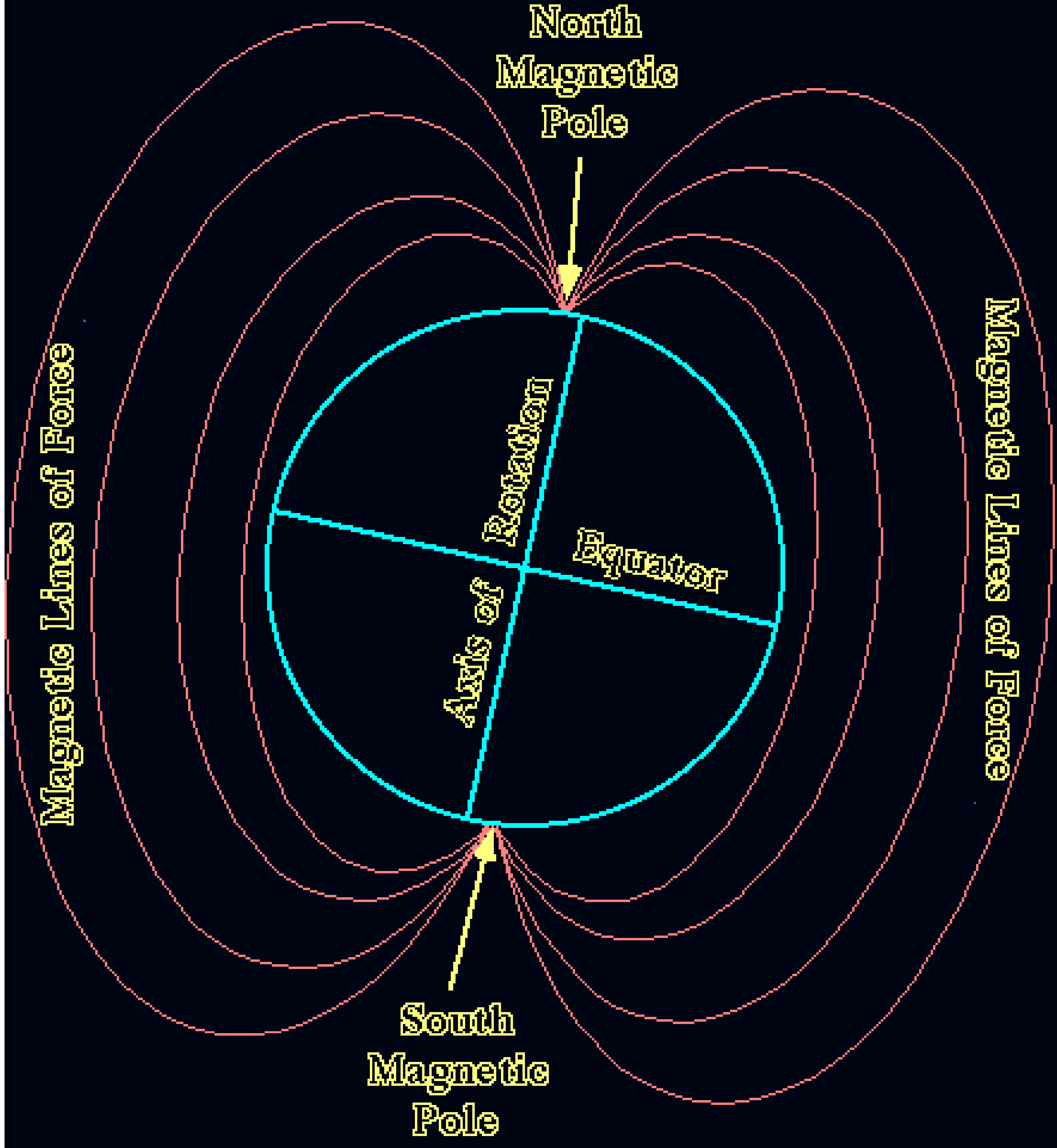
Brunton Compass Tutorial

- Compasses work because the earth acts like a giant bar magnet. Motions in the liquid nickel-iron core of the earth induce a magnetic field with a north and south pole. Magnetic lines of force connect the earth's north and south magnetic poles as show below:
- **Compasses work because a magnetized compass needle will align itself with the earth's magnetic lines of force and point approximately north. I said approximately because you'll note in the figure above that the north and south magnetic poles don't exactly align with the earth's axis of rotation which defines the north and south geographic poles.**

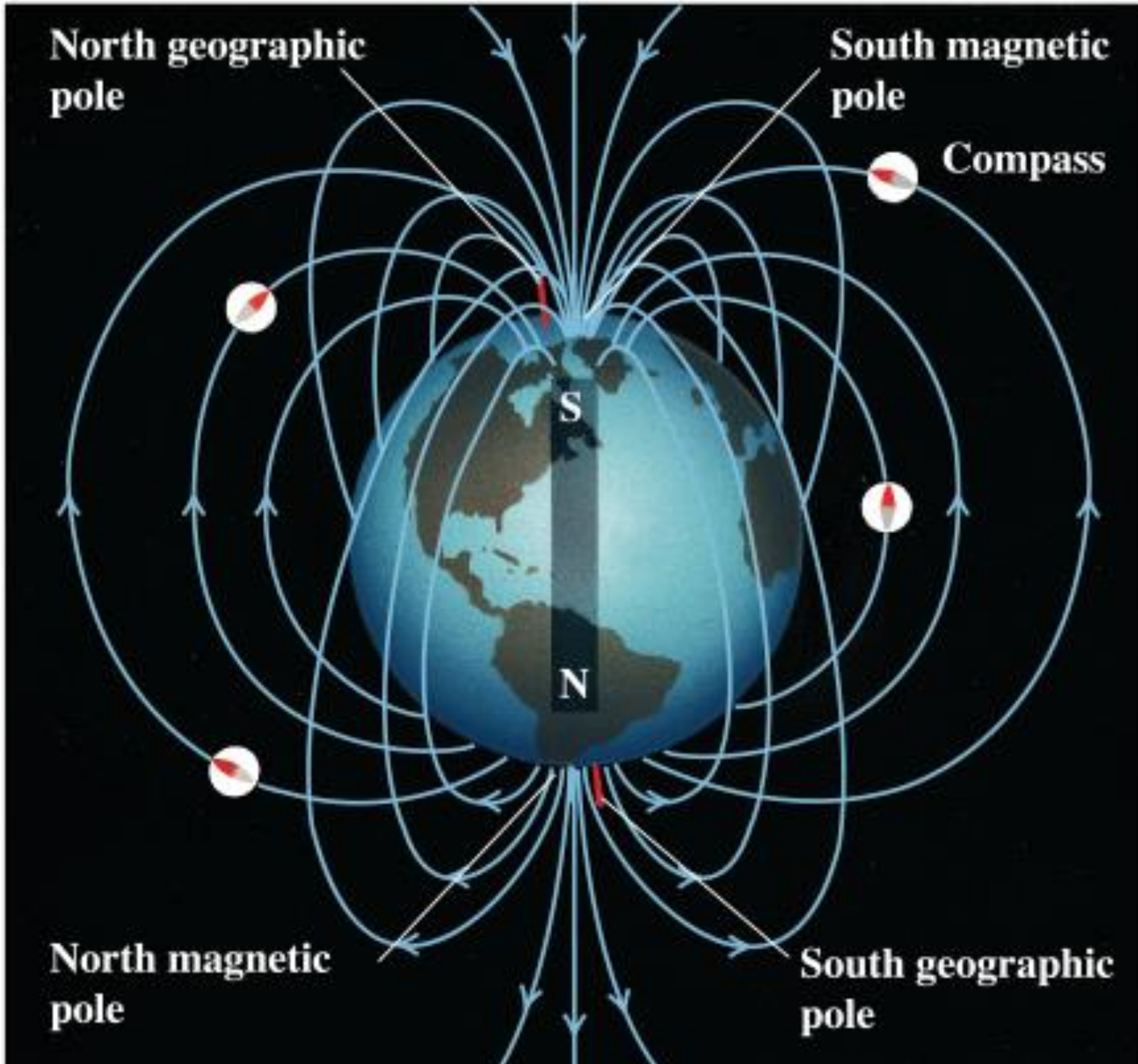
BEWARE!

Compasses can be affected by rocks containing magnetic minerals (e.g. serpentinite, gabbro), iron objects (gates, hammers, cars), and wires with electric currents passing along them (e.g. power lines). Always check odd readings

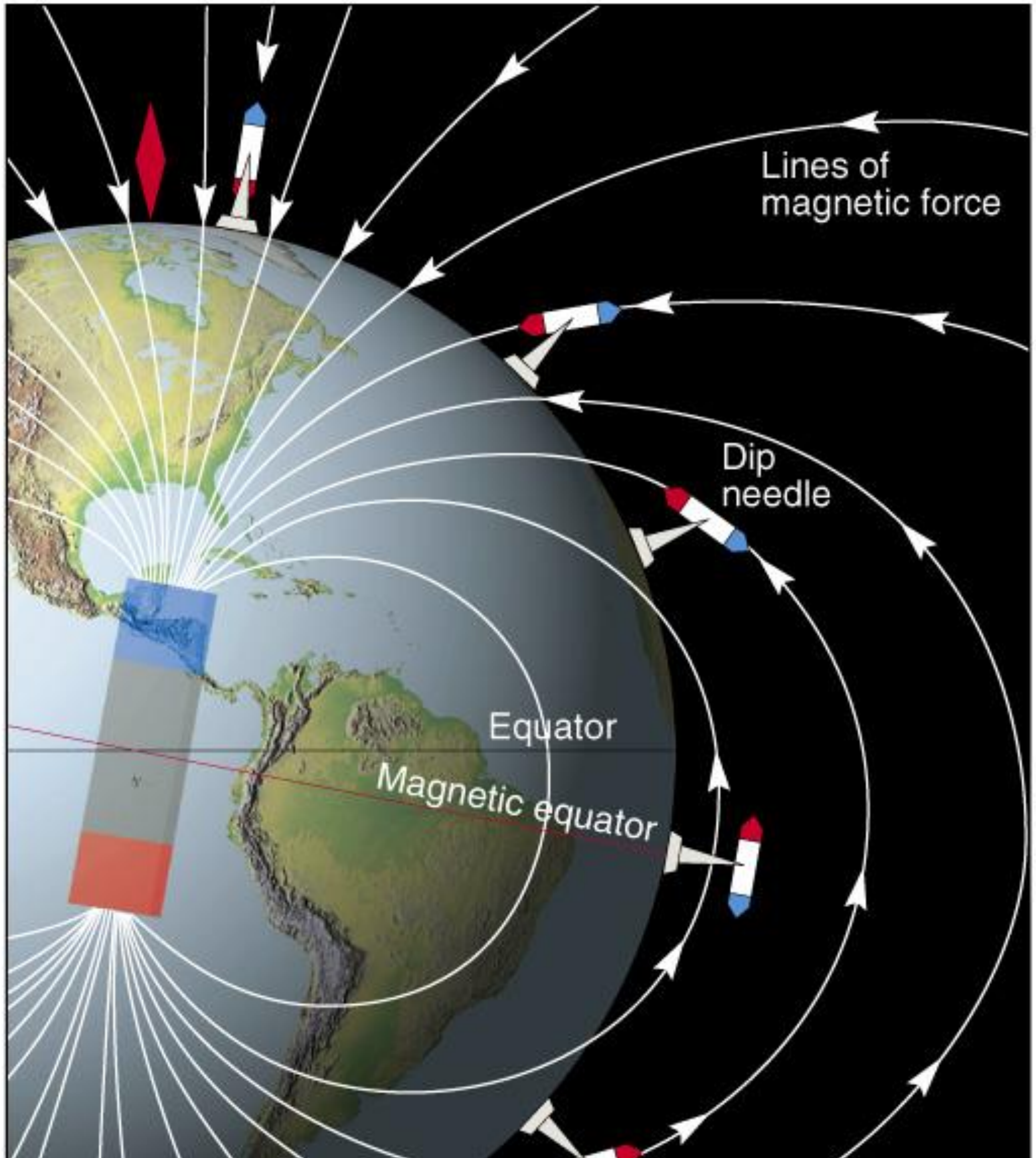
Magnetic lines of force connect the earth's north and south magnetic poles



Earth's Magnetic Field



Earth's Magnetic Field



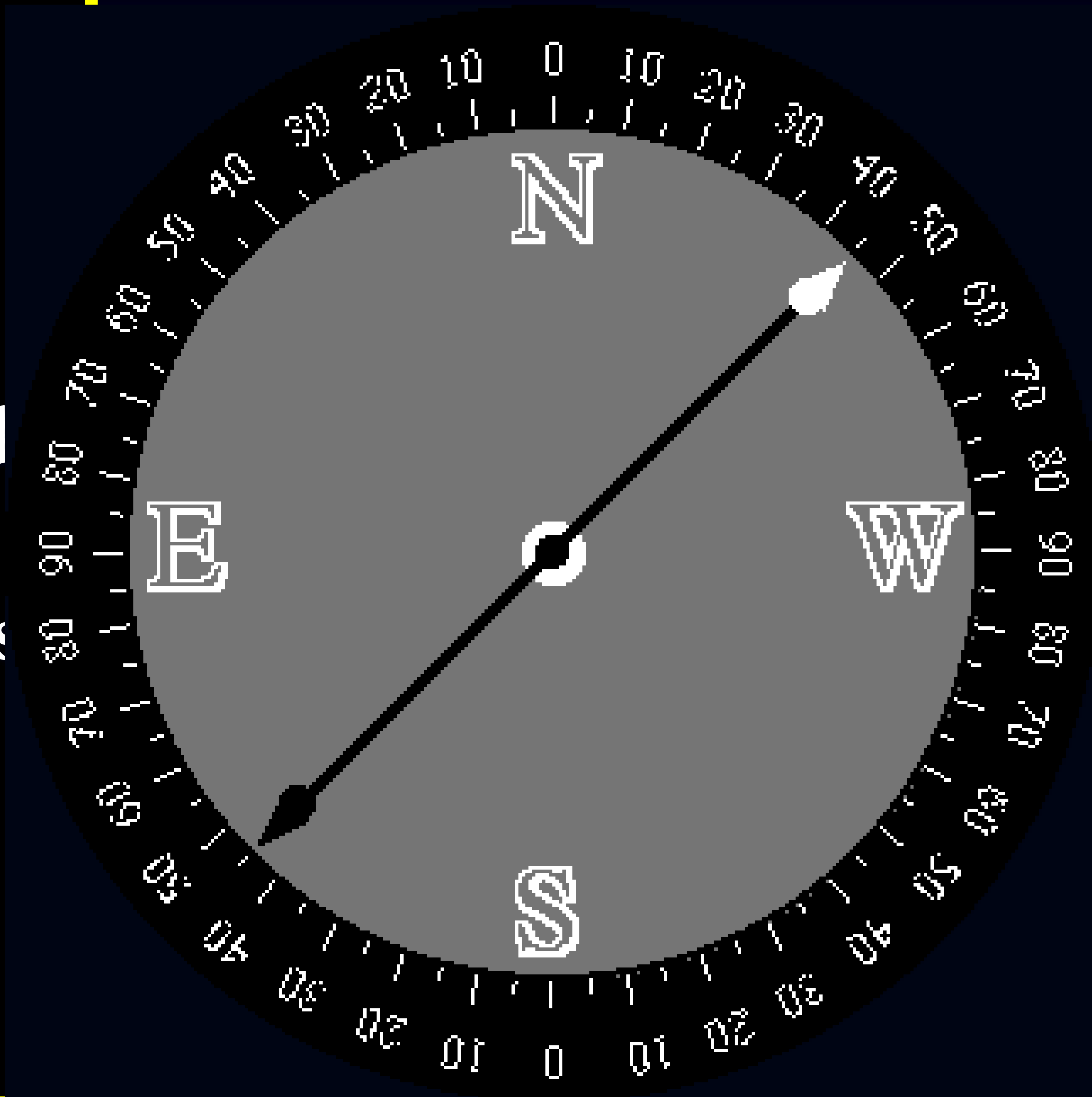
Brunton Compass Tutorial

- Structural geologists use compasses to create geologic maps and measure the orientations of geologic structures. Therefore, in order to do structural geology research in the field, you need to know how a compass works and how to properly use one.

- ## Azimuths vs. Quadrants

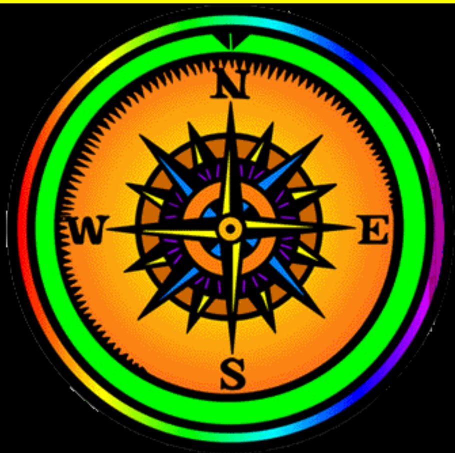
- There are three common ways to express a direction with a compass. The first is to simply estimate your direction as north, east, south, or west. If you want a little more precision, you can use northeast, northwest, southeast, or southwest as well. For this purpose, the compass below would work fine.

E (east) and W (west) appear reversed on the compass

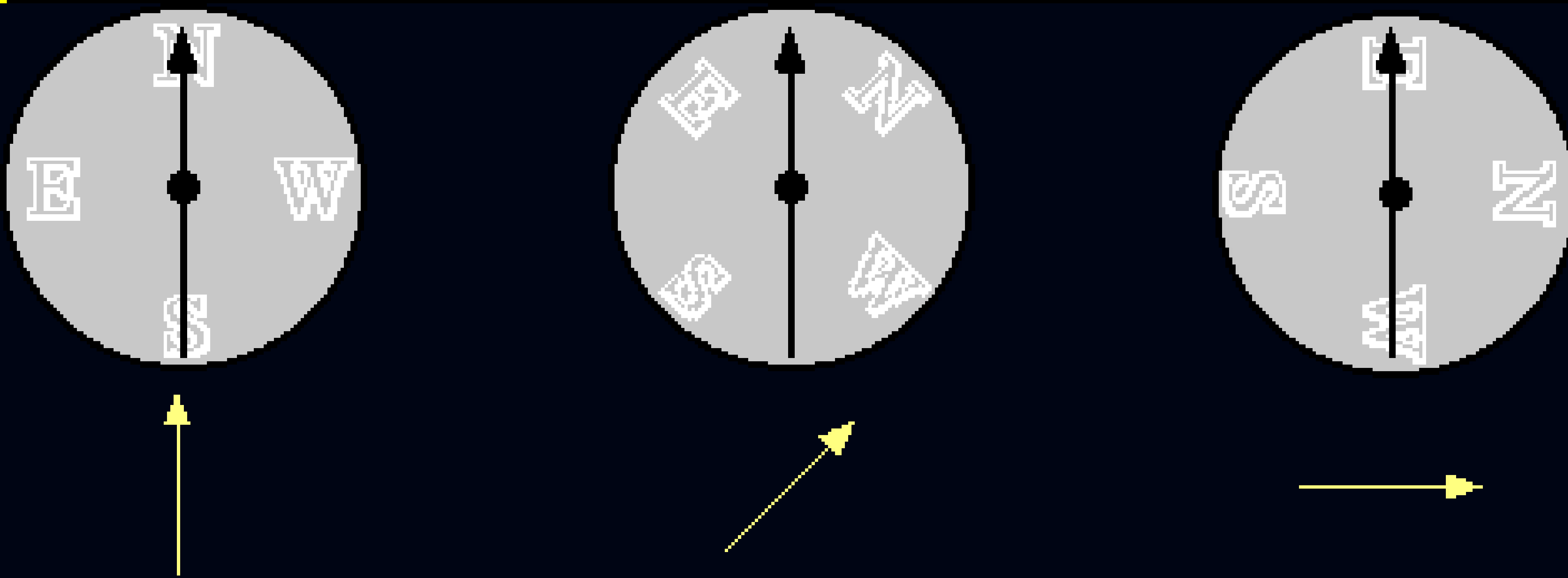


Brunton Compass Tutorial

- Let's take a moment to make sure we understand how such a compass works. Do you know why, for example, that E (east) and W (west) appear reversed on the compass above?
- The compass needle is magnetic and aligns itself with the earth's magnetic field such that the white end of the needle points toward the north magnetic pole (we'll talk about the difference between the geographic north pole and the magnetic north pole shortly). Let's hold a compass while we're facing north. The arrow and the N on the compass will line up as shown below on the left.



E (east) and W (west) appear reversed



You're facing north

You're facing northeast

You're facing east

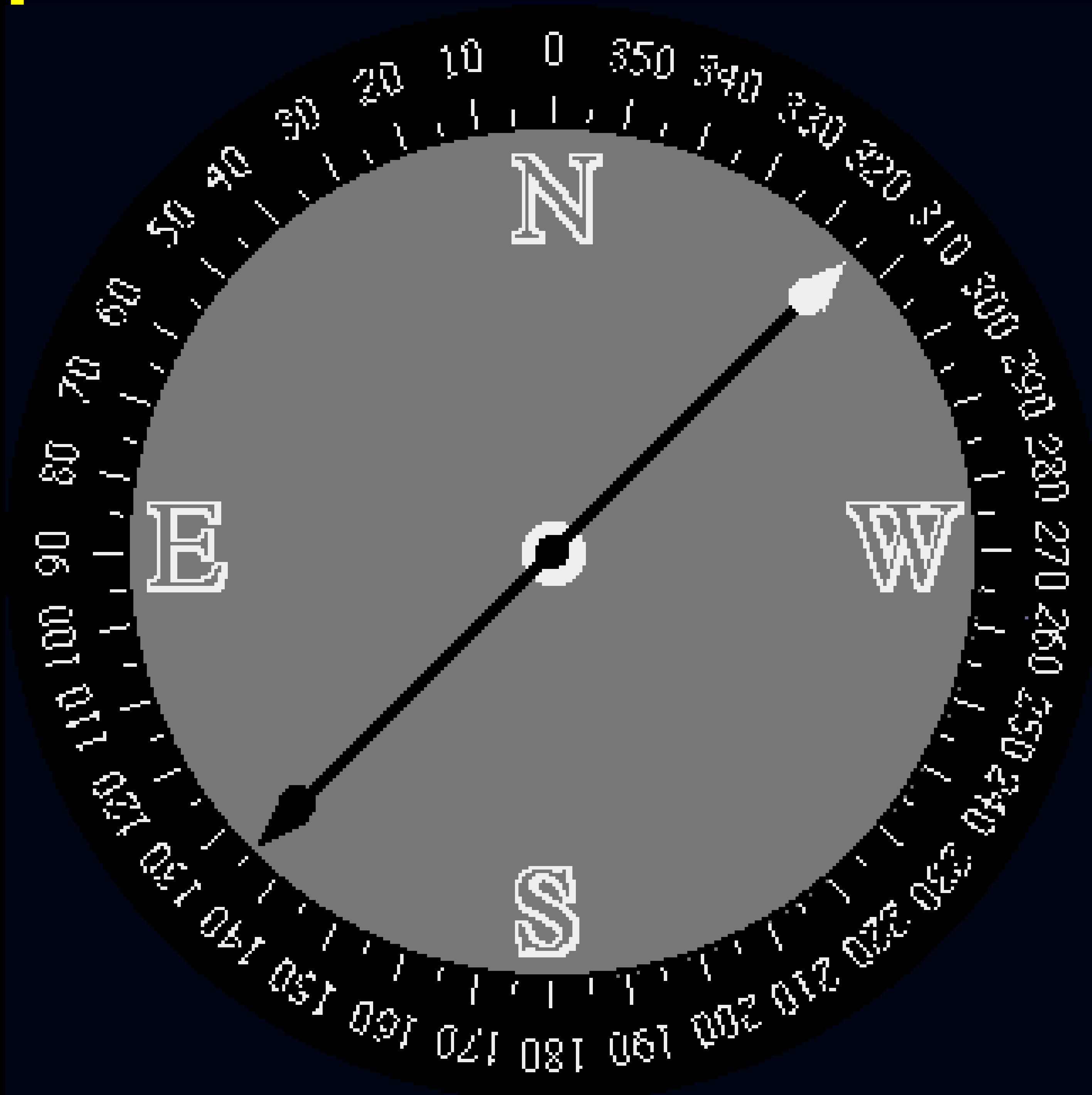
Brunton Compass Tutorial

- Now let's turn and face northeast. The compass needle doesn't move, it always points north, and now it's located half-way between the N and the E (northeast) on the compass. Let's keep turning and face east. The compass needle is still pointing toward the north but now it lines up with the E on the compass indicating that we're facing east. See why the E and W on compass faces are reversed?
- Compasses used by structural geologists commonly come in two forms -- those using the azimuthal notation and those using the quadrant notation. Let's examine each of these in turn...

Brunton Compass Tutorial

- In azimuthal notation, a circle is divided up from 0° deg; to 359° deg; in a clockwise direction. North is 0° deg., east is 90° deg., south is 180° deg., and west is 270° deg.
- In transferring this to the face of a compass, the numbers increase from 0° deg.; to 359° deg; in a counter-clockwise direction (to remain consistent with the reversal of E and W on compasses).
- This is called azimuthal notation. If you were facing east, you would say that the azimuth was 90° deg. If you were facing south, you would say that the azimuth was 180° deg.

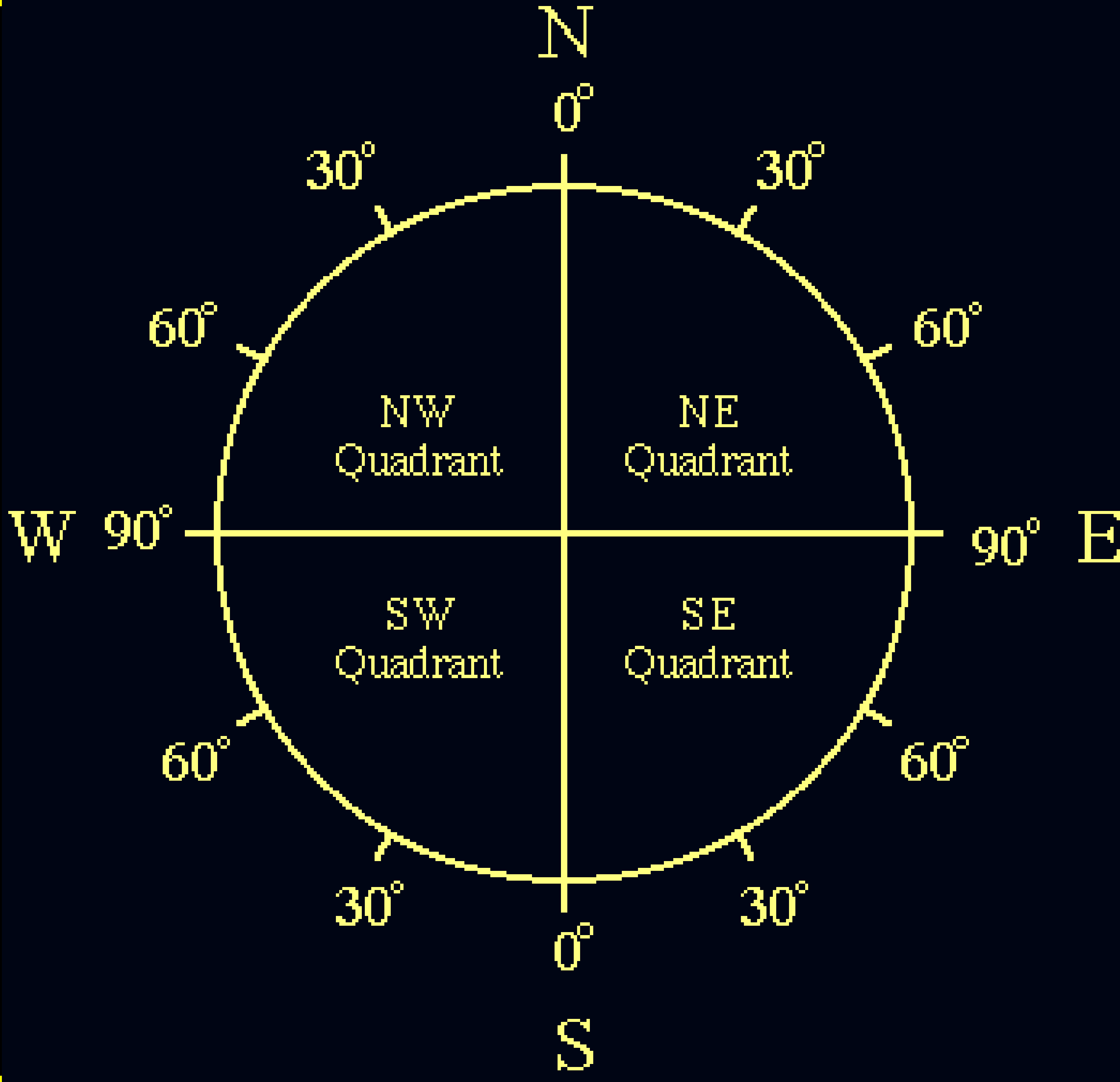
Brunton Compass Tutorial



Brunton Compass Tutorial

- Once again, in azimuth notation, your direction is specified as an angle between 0° deg., and 359° deg., where north is 0° deg., east in 90° deg;, south is 180° deg;, and west is 270° deg;.
- Now let's look at quadrant notation, an alternative to azimuth notation.
- Quadrant notation divides the compass face up into quadrants (think of cutting a pie into four equal pieces). There is a northeast, southeast, southwest, and northwest quadrant. Angles are measured east or west of north and east or west of south as shown below.

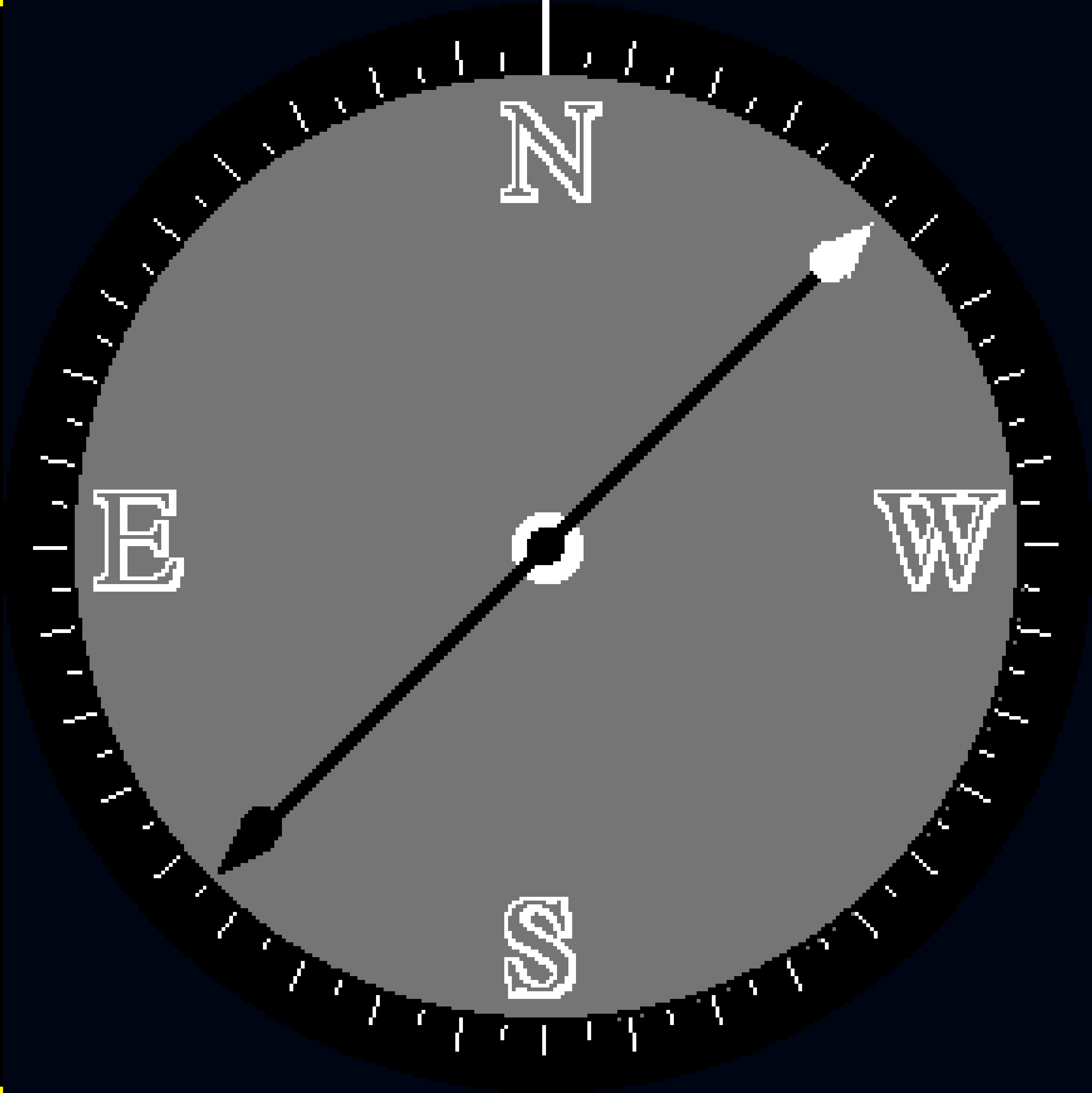
Brunton Compass Tutorial



Brunton Compass Tutorial

- In quadrant notation, you specify a direction as being a certain number of degrees east or west of north or east or west of south (depending upon which quadrant it is). A few examples should clear up any confusion.
- Northeast is 45° deg., east of north, southeast is 45° deg., east of south, and southwest is 45° deg., west of south.
- Some directions may be specified in two ways. East is 90° deg., east of north or as 90° deg., east of south. Similarly for west (it's 90° deg., west of north or south). North is 0° deg., east of north or 0° deg., west of north. Similarly for south (it's 0° deg., east or west of south).

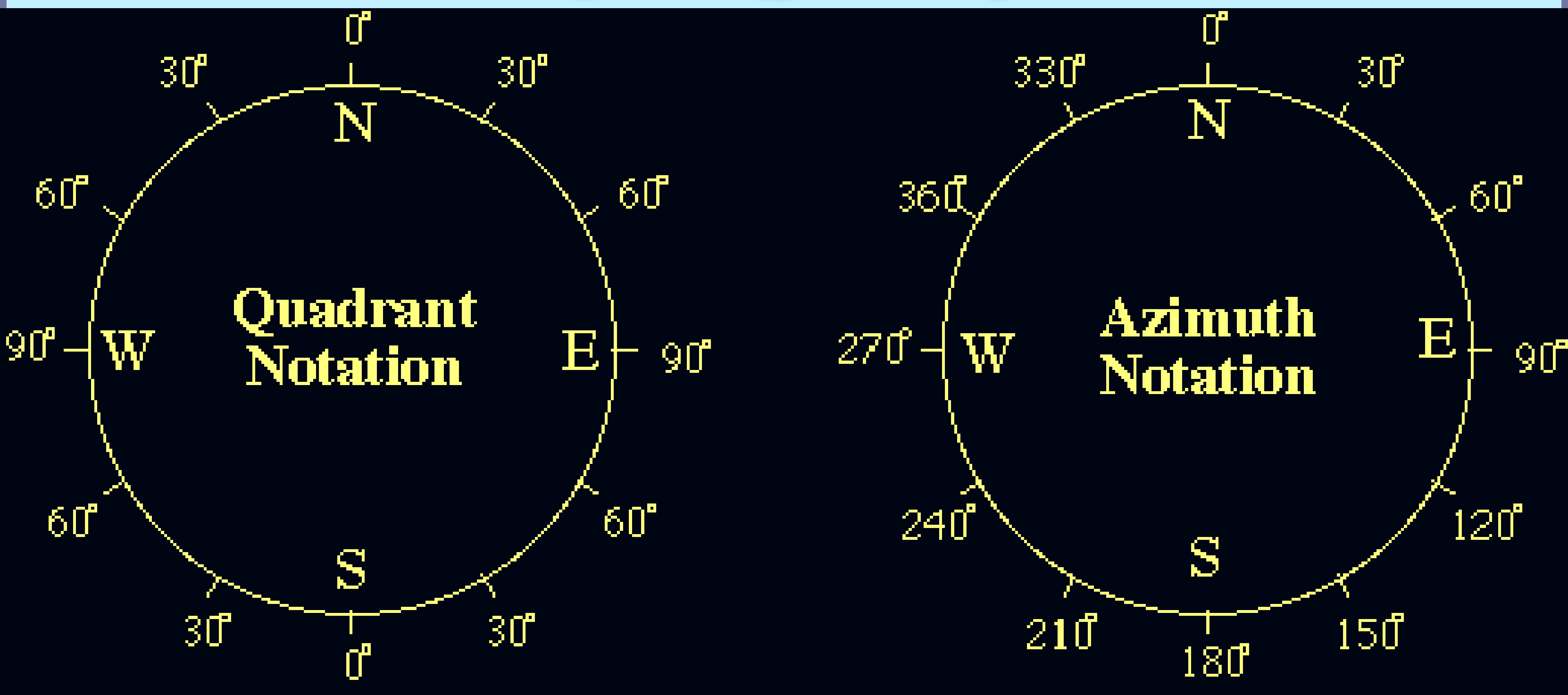
Brunton Compass Tutorial



Brunton Compass Tutorial

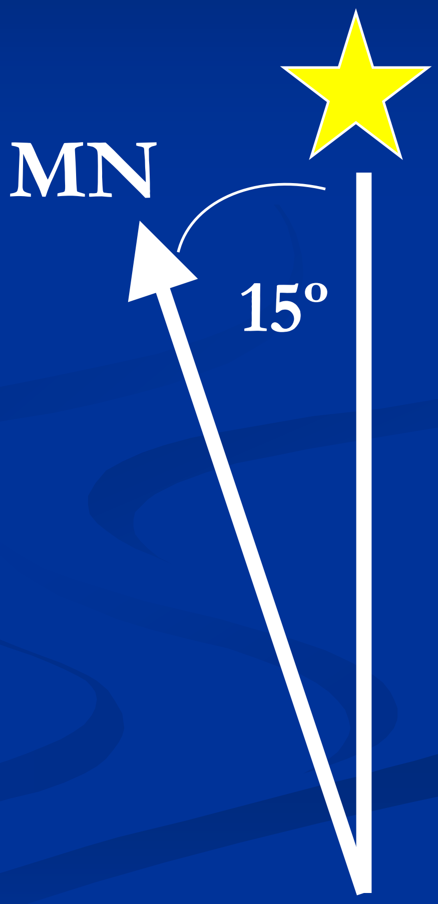
- Converting between azimuth and quadrant notation is pretty straightforward as long as you remember how each are defined. Look at the figure below to compare the two methods.
- The correct way to write a quadrant notation is N or S (for north or south), followed by an angle, followed by E or W (for east or west). Therefore, N45° deg., W is 45° deg., west of north or northwest.
- Above is a compass face set up for quadrant notation and indicating, coincidentally, N45° deg. W.

Brunton Compass Tutorial



Magnetic Declination

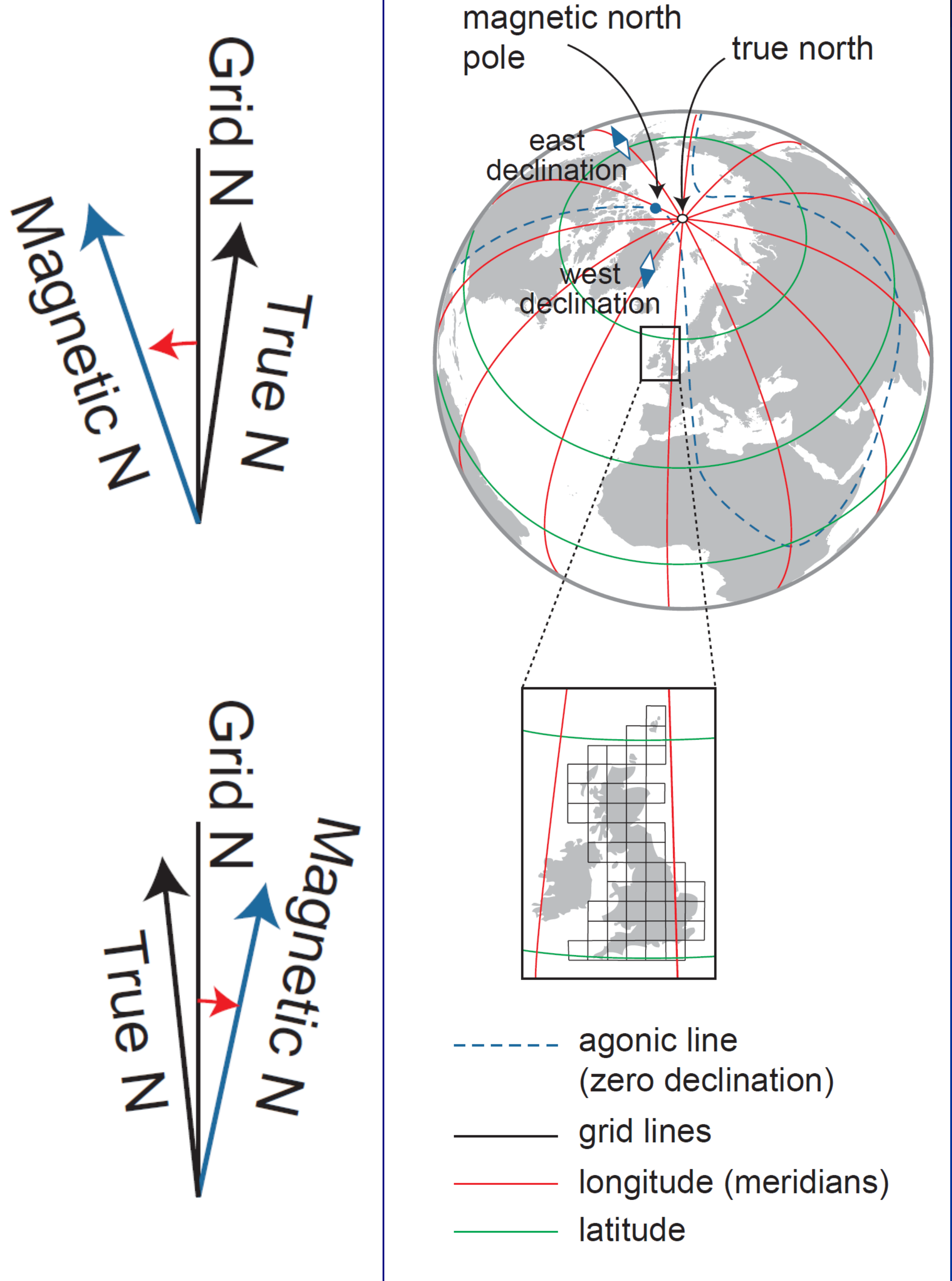
- Many people don't realize that a compass needle does not usually point due north, but at some angle east or west of north. This is because the earth's geographic pole (the axis about which it rotates) is not in the same place as its magnetic pole (the place where the magnetic lines of force emerge from the earth). The direction to the earth's geographic pole is called **true north** and the direction to the earth's magnetic pole is called **magnetic north**.



Magnetic Declination

- The Earth's rotational pole (true north) is not coincident with magnetic north and varies by as much as 30 ° either side of true north and even greater closer to the poles. Not only that, this declination varies with geographical location *and* over time. On maps the N – S grid lines are orientated as close as possible to true north but again this varies by a very small amount depending on your location. This is because grid systems are rectangular but meridians (lines of longitude) converge towards the Earth's pole (Figure 2.4).

- Figure 2.4 (a) Simplified sketch of the Earth to show the relationship between magnetic declination, magnetic north, true north and, via the inset, the longitude, latitude and a grid system (in this case the UK grid squares). (b and c) Typical map information showing magnetic north, true north and grid north. The adjustment of the magnetic declination is shown by the red arrows; (b) is for a westerly declination of magnetic north from true north and (c) is for an easterly declination.



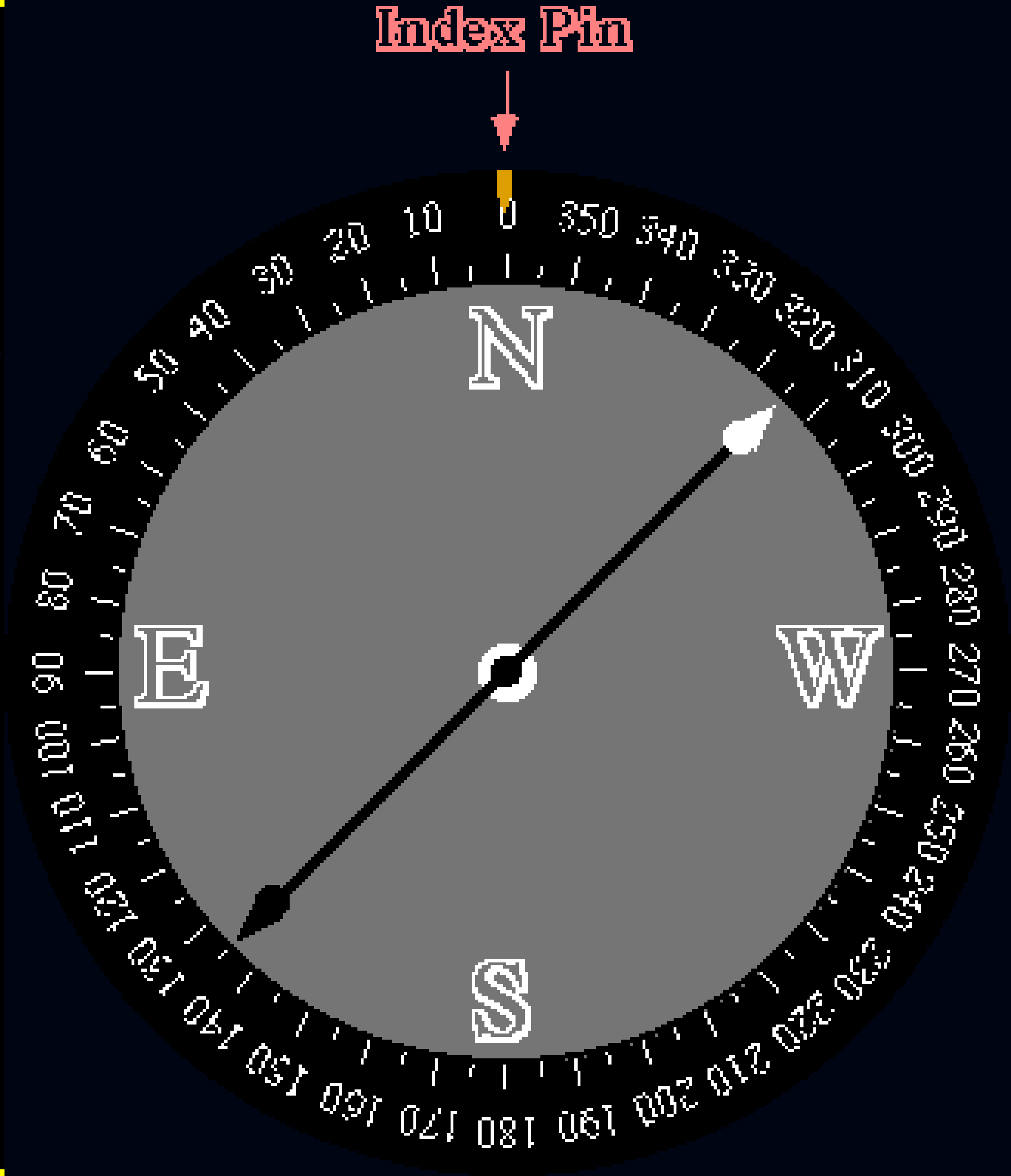
Magnetic Declination

- So, if you're using a compass somewhere on the surface of the earth, you have to account for this difference between magnetic north (where your compass is pointing) and true north (which you need to know). **The angle between true north and magnetic north is called the magnetic declination** and changes with your location and, at any one location, with time.
- How do we determine what the magnetic declination is?
- On a typical topographic map, the magnetic declination is indicated as shown below:

Magnetic Declination

- The star indicates true north (toward the top of virtually all maps) and the MN indicates the direction to the north magnetic pole from the center of the map. In this case, the north magnetic pole is 15º deg., west of true north. This means that your compass, unless you correct it, will point 15 º deg; west of true north.
- There are simple ways to correct for the magnetic declination on most compasses.
- The Brunton compass, which will be discussed shortly, has an index pin at the north end of the compass ring (the ring around the face of the compass with the azimuths printed on it). When the compass is set for a 0º deg., magnetic declination, the index pin is aligned with zero.

Index pin at the north end of the compass ring

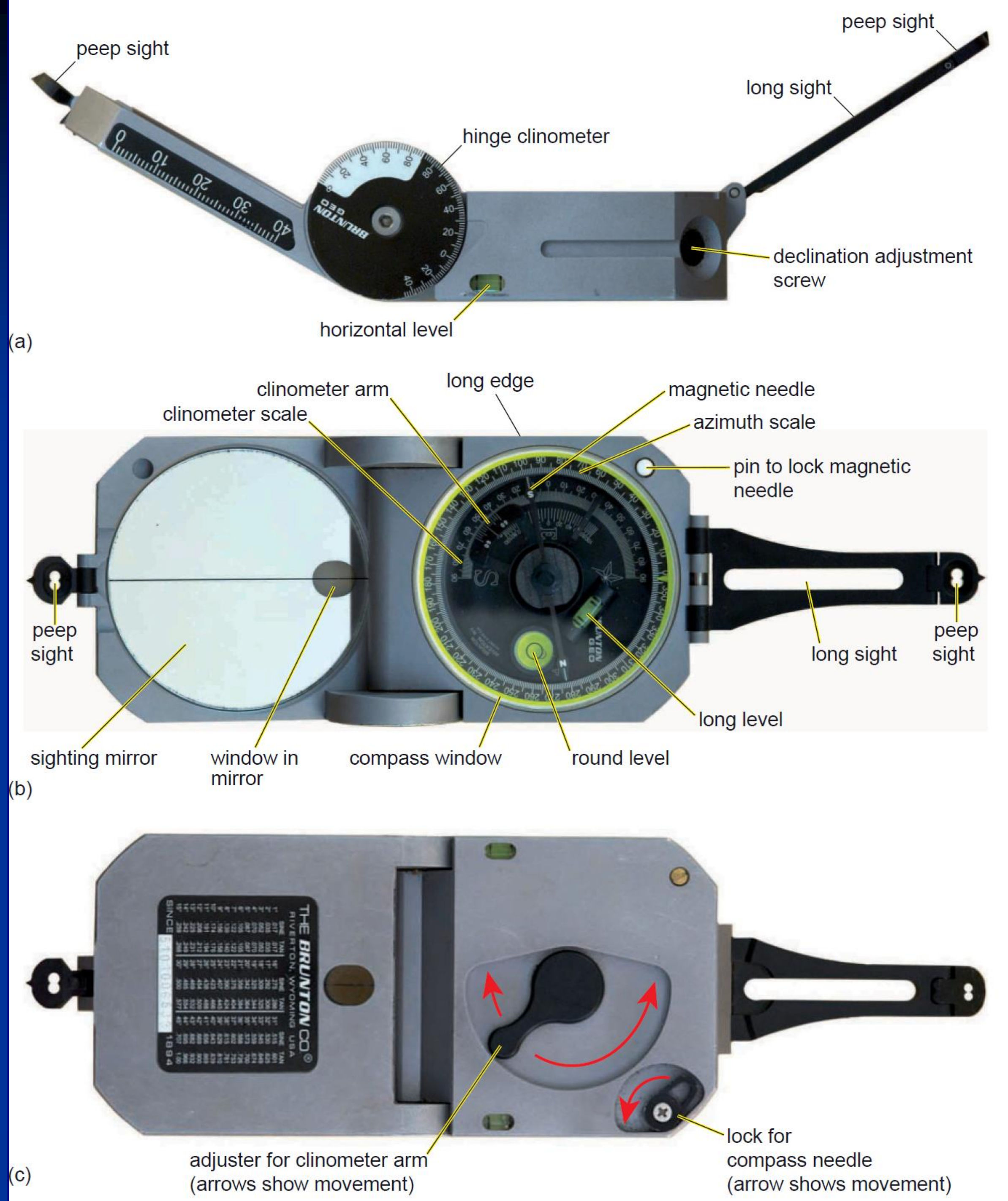


Magnetic Declination

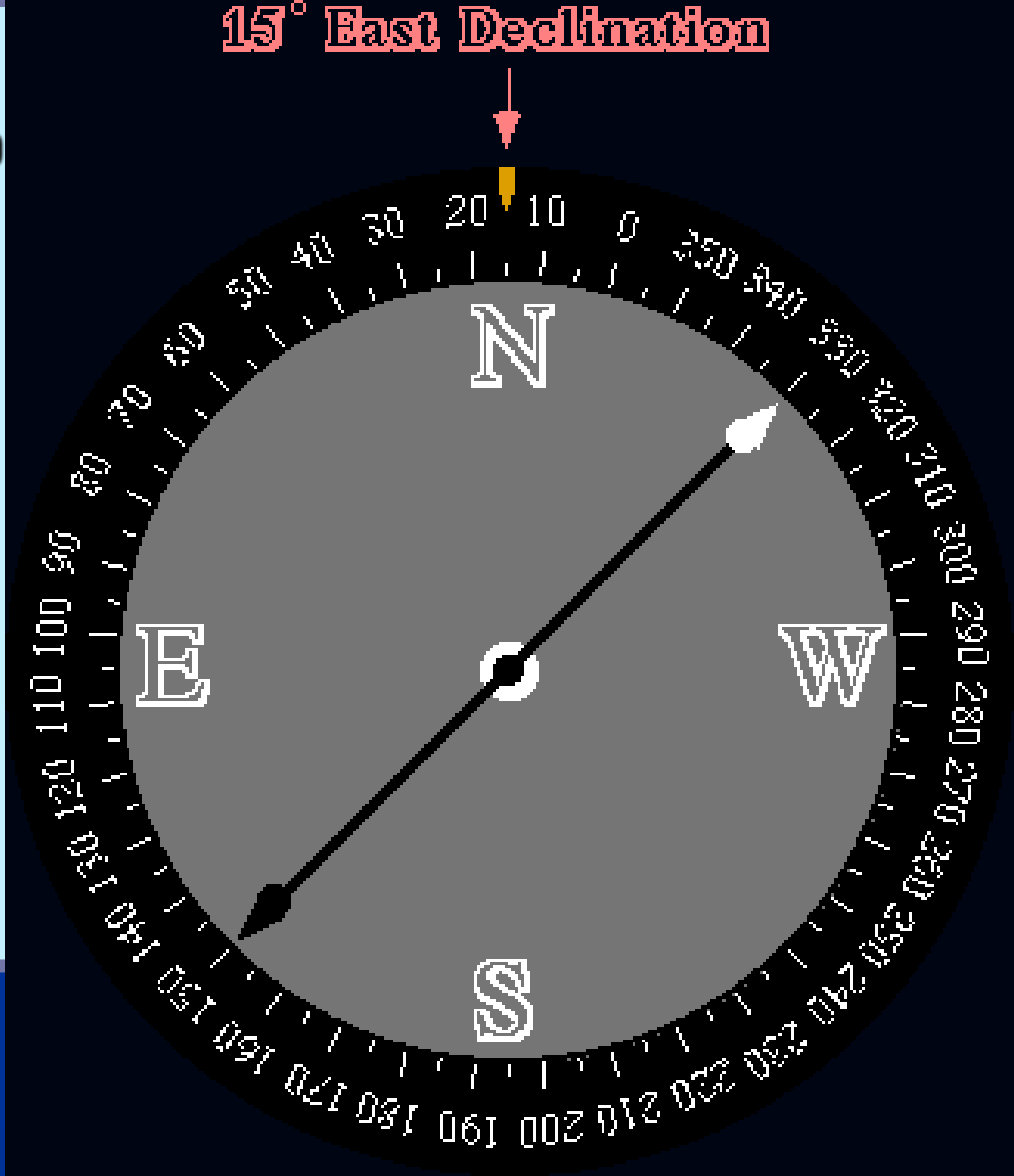
- There is a brass setscrew on the side of the compass which moves the compass ring either clockwise or counter-clockwise. The only trick in correcting for magnetic declination is to remember which way to turn the compass ring for east and west declinations.

➲ **For a magnetic declination 15° deg., east of true north, you would turn the compass ring such that the index pin was over 15° deg., (i.e. 15 ° deg., to the east side of north).**

- Figure 2.3 Labelled photographs of the parts of two of the most commonly used types of compass - clinometer. These terms are referred to in the text and in other fi gures. (a) – (c) The Brunton - type compass - clinometer: in this case the Brunton Geo. Views: (a) side; (b) top; (c) bottom.



For a magnetic declination 15° deg., east of true north, you would turn the compass ring such that the index pin was over 15° deg.,



Magnetic Declination

- For a 15º deg., west declination, you would turn the compass ring such that the index pin was over 345ºdeg.,

- Let's suppose, for example, that you've set your compass for a 15º deg; east declination. You can check to see if the setting is correct by orienting your compass such that the white end of the needle is at 0º deg.,. Rotate the compass 15º deg; east and if the white end of the needle is pointing in the same direction of the sighting arm, which is magnetic north, the declination has been set correctly.

For a 15° deg., west declination, you would turn the compass ring such that the index pin was over 345°deg.,